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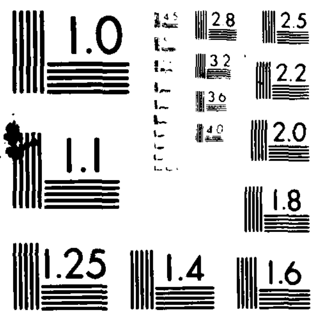

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ORGANIZATIONAL TECHNOLOGY, CONTROL, AND PERFORMANCE:

A STUDY OF THE RELATIONSHIPS AT THE SUBUNIT LEVEL

BY

NESTOR K. OVALLE, 2D

A Dissertation Submitted in Partial Fulfillment
of the Requirements for the Degree of Doctor of Business
Administration in the Graduate School of Business
of Indiana University

Chairman: Professor Bernard L. Hinton

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ABSTRACT

Within the past twenty years the field of organization theory, in attempting to delineate the determinants of organizational performance, has placed a great deal of attention on the relationships between organizational structure and such variables as size and technology. In this regard there is a great deal of controversy in the empirical literature, stemming from contradictory and inconclusive results. Some of the more recent literature suggests that the technology-organization performance relationship might be more appropriately assessed by focusing on the nature of managerial control processes, rather than on structure, as the link between technology and performance.

This field study was performed within a large educational organization in the United States Air Force. The sample consisted of 279 full-time staff employees, representing 70 work-groups within the organization. The study evaluated three hypotheses: (1) that the underlying nature of managerial control can be represented by three independent dimensions, i.e., the degree of personalization in exercising control, the degree of unity in control, and the degree of autonomy given in exercising control; (2) that within work-groups, job technology will explain a significant amount of variance in the control process while controlling for size; and (3) that within work-groups, more variance in performance will be explained by the indirect effects of job technology, mediated by the nature of the control process, than by the

direct effects. The results indicate that the control process is best represented by five dimensions, i.e., job autonomy, acceptance of standards and rules, compatibility among standards and rules, personal-direct control, and rule-use. Furthermore, the results point out that several job technology characteristics are strong predictors of the control process. The findings indicate that several control dimensions are strong predictors of performance. Finally, the results did not indicate that the indirect path between job technology and performance is superior to the direct link. Such findings suggest that further research is warranted. Specifically, additional dimensions of control should be assessed. It is suggested that other variables might be investigated as possible moderators between technology and performance.

ACCEPTANCE

This dissertation has been accepted in partial fulfillment of the requirements for the Degree of Doctor of Business Administration in the Graduate School of Business of Indiana University.

Date December 9, 1981

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The process of scientific research might best be described as a cooperative endeavor. Although a single person may enjoy the responsibility and challenge of applying the scientific method throughout all of its stages, that individual is dependent on many others for ideas, advice, criticism, and encouragement.

It has been my privilege and good fortune to have worked with and received valuable advice and criticism from Professors Bernard L. Hinton, Janet P. Near and R. Stansbury Stockton in every phase of this enterprise. They responded with constructive ideas when I was in doubt and helped me in my own evolution of thinking by challenging me with questions and criticism.

I am also grateful to two fellow student colleagues, Richard C. Hoffman and Richard B. Judy, for their enthusiasm and prodding during the formative days of this research. My sincere thanks to Phyllis Reynolds who typed the entire dissertation without regret, despite the fact that my handwriting was not always clear and intelligible.

Finally, and most of all, I express my gratitude and deepest love to my wife Carol, and to our children Christian, Lita and Brynne for giving and for sacrificing so much. They gave up that evening together, that deserved vacation or that baseball game after dinner while "Daddy" merrily worked on his dissertation. Moreover, they gave me continual encouragement, inspiration and love. For these reasons, I dedicate this effort to them.

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INTRODUCTION

There are three specific purposes of this research. First, I seek to delineate the underlying dimensions of the nature of organizational (or managerial) control processes, defined in general terms as the manner by which an organization ensures that its activities produce desired results. Second, I will examine and test the strength of the relationship between technology, defined in general terms as the nature of the work (or tasks) performed in organizations, and the nature of the control process within subunits (e.g., department or work-group) of similar size. Third, I will examine and test the strength of the relationship between technology, the nature of the control process, and performance within subunits of similar size.

Within the past twenty years the field of organization theory has focused more and more attention on various internal aspects of the organization in an attempt to delineate the determinants of organizational performance. There has been, and still is, a great deal of interest given, for example, to strategy and structure linkages (Galbraith and Nathanson, 1978). Through the so-called open-systems perspective many organization theorists addressed various linkages other than a direct strategy-structure relationship. Among the major areas of study has been that of the context of organizations and some of its more critical components (e.g., environment, size, technology)

as well as the varying effects of these components on the organization. This portion of organization theory relevant to considerations of strategy, structure and organizational performance is usually called contingency theory, the rationale for which was established by Lawrence and Lorsch (1967). Instead of concentrating on just strategy and structure, this school of thought has considered various dimensions of the organizational context and their effects on the organization.

In this vein, one major area of interest among organization theorists has been the study of the manner in which technology and structure are related and, to some extent, how technology, structure and performance are related. Most researchers in this area of study agree that technology is important in the operation of organizations. However, considerable controversy still exists with respect to such issues as how, and to what degree, technology (as opposed to size and environment) and structure are related, and how this relationship affects organizational behavior and performance. For the most part, the debate has centered on technology and/or size with structure at the organizational (or system) level of analysis. The controversy, stemming from contradictory and inconclusive results in the empirical literature, is partially a function of such things as differences in the units of analysis studied and lack of agreement in operationalizing the variables (Ford and Slocum, 1977).

Moreover, some of the more recent literature has suggested that the technology-organization relationship may not yet be appropriately conceptualized. For example, Bobbitt and Ford (1980) proposed that

the analytical framework of current structure-contingency models fails to include the "decision-maker's choice" as a determinant of structure. Hall (1977) posited that organizations do not respond to technology through "absorption," suggesting that we must change our framework and look more at the "processes" occurring within organizations rather than emphasizing the effects of technology on the formal structure. Woodward (1970) offered one of the most explicit reconceptualizations of the technology-organization relationship by proposing that we spotlight the relationship between technology and the nature of organizational control process. She implied that this approach might illuminate the linkage between technology and organizational behavior and/or performance. Hunt and Near (1980) offered a similar suggestion. It is essential to note that this theoretical framework (looking at a technology-control process-behavior linkage) is based on the premise that structure and the process of control are not equivalent in meaning (a point I will elaborate upon later). These two terms have not always been clearly distinguished by many social theorists. For example, March and Simon (1958) (in reviewing the work of Merton, 1940; Selznick, 1949; and Gouldner, 1954) described the structure of the organization as the essence of control. However, I agree with Thompson's (1967) assertion that it is the needs for coordination and control which result in the effects of a given technology ("core technology") on structure.

Further, I agree with Bobbitt and Ford's (1980) assertion that the decision maker has been excluded from the explanatory models. A viable way of including this crucial component is by concentrating

more on the processes exercised by decision makers to ensure that the organization produces the desired outcomes (performance). This major process is referred to as organizational or managerial control. Moreover, it is suggested here, much like Woodward (1970), that research should explicitly explore the nature of organizational control processes. Additionally, research should then examine the relationship between organizational technology, control and performance while accounting for the effects of size. Furthermore, it appears that there is a great need to analyze these relationships at the subunit level of the organization (e.g., Gerwin, 1979; Hunt and Near, 1980).

The field of organization theory has been characterized by two distinct approaches to the area of organizational technology. Slocum and Sims (1980) describe these as a macro- and a micro-perspective. The macro-perspective has centered on the influence of organizational technology (and other contextual factors) on the formal organization structure. The micro-perspective has focused on job technology (work characteristics) and its effects on the individual (and work-group). Slocum and Sims (1980) argued that little effort has been given to integrating these two perspectives. They recommended a systematic examination of the interrelationships of technology, managerial and self-regulating control systems, and the design of jobs. This study includes both perspectives as it incorporates both macro and micro dimensions of organizational technology and focuses on the process of managerial control.

In summary, there are three purposes to this study: (1) to delineate the dimensions of the nature of organizational control

process, (2) to examine the relationship between technology and the nature of control processes within subunits of similar size, and (3) to examine the relationship between technology, the nature of control processes and performance within subunits of similar size. Chapter I provides a review of the literature pertaining to the concepts and variables pertinent to this research and concludes with a description of the three research hypotheses of this study. The second chapter presents the research methodology. Chapter III reports the results of the research. The fourth chapter summarizes the study, presents conclusions and discusses implications for further research.

CHAPTER I

REVIEW OF THE LITERATURE AND RESEARCH HYPOTHESES

This chapter begins with a brief description of a general model of the organization which depicts the relationships examined in this study. Following the general model, a review of the literature is presented under three distinct headings. First, literature is reviewed pertaining to technology and the debate with respect to the relationship between technology (versus size) and structure. Second, literature is reviewed pertaining to organizational control and the linkage between technology, control and performance. Third, a review of the literature most pertinent to measuring performance is presented. Following this review of the literature, the hypotheses of this study are presented.

General Model of Organizations

Before reviewing the literature as it pertains to the specific variables and relationships of interest in this research, I shall describe my view of the organization in terms of a more general model. This general model is shown in Figure 1.

This model is provided to show some of the basic components of the organization, the contextual variables and the relationships of

CONTEXTUAL VARIABLES →	ORGANIZATIONAL & MANAGERIAL FACTORS →	COMPONENTS OF STRATEGY (STRUCTURE & PROCESSES) →	ORGANIZATIONAL OUTCOMES (FACETS OF EFFECTIVENESS)
1. ENVIRONMENT (e.g., uncertainty) 2. SIZE (e.g., number of personnel)	1. GOALS 2. MANAGERIAL COMPONENT	1. STRUCTURE (organizational form) -Administrative intensity -Complexity/differentiation -Formalization Centralization	1. ORGANIZATIONAL CLIMATE Morale Satisfaction Conflict
3. TECHNOLOGY (the nature of the tasks) Dimension: technological routineness Measures: -Task predictability & variability -Task difficulty -Task interdependence -Product standardization		2. PROCESS OF CONTROL (process of ensuring that activities produce desired results--includes planning & objective setting, and the monitoring & evaluation) Dimensions: degree of personalization in exercising control degree of unity in exercising control degree of autonomy	2. BEHAVIOR & PERFORMANCE Individual Work-group Organization

Fig. 1. General Model of Organizational Relationships

interest in this research; therefore, it is not intended to describe all the complex phenomena of interest to social theorists.

I adopt the contingency (versus universalistic) perspective in viewing the dynamics of an organization. Specifically, this theory is based on two conclusions: (1) there is no one best way to organize, and (2) not all the ways to organize are equally effective (Galbraith, 1977). Another general premise of this model is that although my conceptual and analytical framework argues for the primacy of technology as an influence on components of strategy, this does NOT necessarily imply absolute technological determinism. In other words, for purposes of analytic strategy, I consider the contextual variables to be independent variables and, ultimately, organizational performance to be the dependent variable. However, as I proceed analytically from contextual factors through the components of managerial strategy (e.g., structure and control processes), to desired outcomes (e.g., performance), the prior variable only sets increasing limits upon the range of possible variations in the next variable. Furthermore, this model proposes that through a feedback process, organizational outcomes may induce new managerial strategies with respect to structure and the control process, as well as initiate attempts to influence the contextual factors (Perrow, 1967; Child, 1975; Montanari, 1978; Bobbitt and Ford, 1980).

In the context of the preceding comments, I assume, on the basis of contingency theory, that organizational performance is influenced to a great extent by the fit between certain contextual factors (i.e., size, environment, and technology) and certain components of

strategy (i.e., the structure and control processes). This study will specifically center on the contextual factors of technology and size, since these appear to be the variables of greatest controversy in the literature.

The manner by which I describe technology, (i.e., as the tasks individuals perform upon some object in order to change that object), is similar to Perrow's (1967) meaning. Accordingly, this definition does not limit the focus on technology as a production system, as do other studies (e.g., Woodward, 1965). Instead, it accents the work done in all parts of the organization, and specifically emphasizes the levels of the operator and the work flow. Moreover, the manner in which I describe organization control, (i.e., as the setting of objectives and procedures as well as the monitoring and evaluation of behavior), permits me to examine control as a process (how the organization controls) rather than limit the focus to merely what is controlled, (i.e., output or behavior as exemplified in the work of Ouchi and Maguire, 1975; Ouchi, 1977).

Technology and the Technology/ Size-Structure Debate

The study of technology can be traced back at least as far as the period of scientific management where Frederick W. Taylor related technology to productivity in order to improve the techniques of task accomplishment. In later years, particularly during the period of the human relations school, emphasis was placed on the social structure in the organization and its relationship to the

performance of individuals and groups, and attention to technology was minimal (Scott and Mitchell, 1976; Kast and Rosenzweig, 1979).

During the 1950s there was a reawakened interest in technology in the study of organizations with the appearance of socio-technical theory (Trist and Bamforth, 1951). This framework highlighted the relationship between the technical system used to perform the tasks and the social system, by pointing out the disruptive effects of technological changes on the social structure. The works of Walker and Guest (1952) and Thompson and Bates (1957) also contributed to this revived interest in the relationship between technology and structure. The former study related technology to job satisfaction and to social interaction, while the latter showed that the type of technology which is suitable to certain goals sets limits on both structure and various organizational processes.

In the 1960s, Burns and Stalker (1961) suggested that an important component of environmental uncertainty was technical innovation (technological change), and that different rates of innovation produced different kinds of structures (termed "organic" and "mechanistic"). Similar findings were provided by Lawrence and Lorsch (1967).

The work of Joan Woodward and a team of researchers (reported in Woodward, 1965) stimulated many studies and much of the controversy concerned with the relations between technology and structure that have emerged in the past fifteen years. Her research introduced the argument of a "technological imperative." The basic argument posited that differences in structure are related to technological complexity, measured on a scale with three major types of technology (unit or

small batch, mass or large batch, and continuous process). In general, organizations with the two extreme types of "complexity" (unit and process) had "organic" structures while those with moderate complexity (large batch) had more "mechanistic" structures. Furthermore, within each technological category, organizations which most nearly conformed to the median scores for structure were financially more successful than organizations below and above the median. From this finding she concluded that success (economic performance) depends on the fit of an organization's structure for a particular "operation" (or production) technology.

Subsequent research by Harvey (1968), Zwerman (1970), Khandwalla (1974) and Blau, et al. (1976) provided support for Woodward's general conclusions. However, even among these supporting works, we find differences in the operational definitions and measures of both technology and structure. For example, Harvey (1968) claimed that Woodward's scale measured the degree of specificity or routineness (versus complexity) of technology, where specificity was inversely related to the number of major product changes. Khandwalla (1974) added greater specificity to these conclusions by taking into account the fact that firms may employ multiple technologies. Nevertheless, Woodward's work gave rise to more studies which also considered technology to be an important variable, many of which also measured technology in terms of the complexity of the entire production system (e.g., Meissner, 1969; Fullan, 1970; Zwerman, 1970; and Grimes and Klein, 1973).

Following the initial work of Woodward, there were numerous studies which used quite different measures of technology and methods of data collection and which questioned the importance of technology. The most prominent of these studies was the effort of the so-called Aston Group. Specifically, the work of Hickson, et al. (1969) stimulated a change in the research focus, from one of describing a direct relationship between technology and structure to one of considering the effects of other variables. Hickson, et al. (1969) developed a classification of technology based upon two concepts. First, they concentrated upon production continuity and classified the "complexity" of operations technology by using a modified version of Woodward's (1965) scale. Second, they focused upon a variable called "work flow integration." This variable consisted of five subscales measuring such elements as the degree of automation, work flow rigidity, the interdependence of different segments of the work flow, and the specificity of evaluations of operations. Their measures of technology and structure reflected executives' perceptions in their organizations. Hickson, et al. (1969) concluded that whereas technology may affect structure in small organizations (such as Woodward's, (1965) sample firms, which were much smaller), size is the major determinant of structure. The scales developed by the Aston Group to measure technology do not appear to be totally dependent on a classification based on the dominant production process (Jackson and Morgan, 1978). However, their measures of "work flow" characteristics could not easily differentiate among the technologies of many types of organizations, e.g., service organizations (Hickson, et al., 1969; Lynch, 1972).

The Aston studies prompted various other studies to evaluate the controversy of size versus technology in affecting structure. Child (1972b) replicated the Aston group's investigation on a more heterogeneous sample. Based on the results of this study, as well as the work of Child and Mansfield (1972), it was concluded that size is more strongly related to overall aspects of structure, while technology is more strongly associated with configuration variables (i.e., functional specialization and centralization). It was concluded that technology has its strongest ties to structure in smaller firms. Child and Mansfield (1972) concluded that the two approaches (i.e., size and technology) were not so much in conflict but rather that researchers had been studying different facets of the organization. Child (1972b) proposed that differences in the results of the research pertaining to technology, size and structure may be partially attributed to differences in definitions and in the unit of analysis. Finally, Child and Mansfield (1972) suggested that technology is multidimensional, a conclusion drawn also by Mohr (1971). This conclusion is based on their findings that the individual subscales of work flow integration (the Aston technology measure) were not in all cases associated with each dimension of structure.

Inconsistent findings continued with later studies. For example, Child (1973) established that work flow integration was not related to centralization or to formalization but was related to functional specialization and standardization. Meanwhile, Payne and Mansfield (1973) found that work flow integration was related to formalization as well as being related to functional specialization.

Aldrich (1972), in re-examining the Aston group data, questioned the Aston group's rejection of technology as a crucial variable.

Thus far in the discussion, we have reviewed the research efforts of Woodward and supporters of the technology-structure argument, and those of the Aston group and supporters of the size-structure argument. The studies cited do not unanimously call for a one-to-one determinative association between structure, and either size or technology. However, given the controversies and inconsistencies in findings among these researchers, it might be useful to briefly point out what they share in common and, thereby, help identify where they might be deficient.

First, most of these studies have focused primarily on operations or production technology, i.e., on the methods used in production. Few of these studies stressed materials technology, i.e., the characteristics of the materials used in the work flow such as their uniformity and stability. None of these studies centered on knowledge technology, i.e., the characteristics of the knowledge used in the work flow such as the predictability and variability encountered in the work (Perrow, 1967).

Second, most of these studies have restricted themselves to one measure of technology, yet some have suggested the multidimensionality of technology (e.g., Child and Mansfield, 1972). Third, most of these studies have accentuated the technology-structure relationship at the system level of the organization and, for the most part, gathered their data from the senior management/executive personnel in the organizations. As is amply demonstrated by the work of the Aston

group (Pugh, et al., 1968; Hickson, et al., 1969; Pugh, et al., 1969), both technology and structure are complex and multidimensional variables at this level, yet we find the researchers each selected different dimensions or subdimensions to represent each of these variables (Stanfield, 1976; Reimann, 1980). Also, it is extremely difficult to take into account the possible existence of multiple technologies in a firm when the focus is at the system level. Furthermore, one must question the logic of conceptualizing, and then measuring, technology in terms of the "work flow," while trying to establish relationships with structure measured at the system level. For these reasons alone, it should not be surprising that there is a considerable variation in results between studies.

Fourth, these studies do not provide the framework for studying technology in a non-industrial setting; that is, their operational definitions of technology cannot be easily applied to (for example) service organizations (Lynch, 1972). Perhaps greater emphasis should be placed on operationalizing technology in terms of the "tasks" performed in organizations at the operator and work flow levels as suggested by Hunt (1976). In this regard, the work of Comstock and Scott (1977) suggests that technology and structure may be more significantly associated at the subunit level rather than at the system level.

Finally, the emphasis on structure has ignored the crucial element of managerial choice, as expressed in various works (e.g., Child, 1972a; Child, 1974; Child, 1975; Montanari, 1978; Bobbitt and Ford, 1980). Specifically, the major common elements of structure

that have been considered are the extent of differentiation (or complexity), administrative intensity, formalization, and centralization (Ford and Slocum, 1977). With the possible exception of formalization (and to some extent centralization), most researchers have defined structure in such a way that the analysis has been heavily dependent on structural configuration (or organizational form). Very little, if any, attention has been given to the strategic processes, which are to some extent related to structural configuration and which are ultimately determined by managerial choice, e.g., the process of control.

The succeeding paragraphs will review the literature of yet another framework of technology in organizations--the framework which is adopted in this study. As this framework is presented, specific attention will be placed on treating most of the problems identified above.

As previously discussed, one of the major limitations of most of the studies reviewed above is that their theoretical framework restricted the focus to "operations technology" and to technology at the systems level. This has seriously limited our ability to evaluate different technologies within organizations and to assess the technologies of many different types of organizations. Perrow (1967) has provided a conceptual framework which is sufficiently broad and does permit multiple technologies to be studied. His work considers technology to be the defining characteristic (the independent variable) of organizations. Specifically, organizations are seen primarily as systems for getting work done; technology is seen as the work done

in organizations; structure is viewed as the arrangements among people for getting work done (Perrow), 1967).

By technology, Perrow (1967:195) means:

> . . . the actions that an individual performs upon an object, with or without the aid of tools or mechanical devices, in order to make some change in that object. The object, or "raw material," may be a living being, human or otherwise, a symbol or an inanimate object.

Another way Perrow has described his meaning of technology is as a set of "programs and strategies" to be put into effect when new "stimuli" appear in order to change raw materials into goods or services (Magnusen, 1970; Lynch, 1972). Essentially, Perrow's meaning of technology is a "cognitive" one, i.e., he was not referring to the essence or nature of the raw material, only to the "way the organization" (or organizational members) "perceives it" (Perrow, 1967). According to Perrow there are two dimensions to this cognitive technology: (1) the "number of exceptional cases" encountered in the work (refers to the perceived nature of the raw materials), and (2) the degree to which the "search" behaviors (undertaken by individuals when exceptional cases appear) are capable of being analyzed (Perrow, 1967). Perrow made the individual task the basic ingredient of organizational technology (Lynch, 1972), thereby permitting an evaluation of technology at the individual and subunit levels.

Although Perrow's conceptualization makes it necessary to question the worker, he avoided the necessity of inferring a reality from a response by basing his definition on the worker's perception. Furthermore, his theoretical framework made possible the analysis of

work in many different settings, i.e., not just industrial settings (e.g., Hage and Aiken, 1969; Lynch, 1972).

In succinct form, Perrow (1967) posited two general relationships with respect to technology and organization structure. First, he maintained that routine technology is characterized by few exceptions and an "analyzable search" and, since organizations attempt to maximize the fit between technology and structure, a "bureaucratic" structure is most effective in this situation. Second, Perrow claimed that non-routine technology is characterized by many exceptions and an "unanalyzable search," and a more "organic" structure is most effective in this setting. Perrow (1970b) and Magnusen (1970) found support for these hypotheses in a later study. However, Perrow could not easily operationalize his four-cell technology classification scheme.

Hage and Aiken (1969) based their study on Perrow's theory, but defined technology as overall routineness in the work, using a five-item scale to measure overall technology. They found a significant association between routineness and both formalization and participation in decision making. Dewar, et al. (1980) examined the task routineness scale used by Aiken and Hage (1968) and Hage and Aiken (1969). While the scale was found to be reliable and valid, it was limited to indicating only perceived variability and not the perceived analyzability of technology.

Lynch (1972) developed a seven-item measure of the technological variability of tasks, based upon Perrow's theory, with which she was able to successfully discriminate among the technologies of library departments. Although Lynch's (1974) technology measure

provided a means of assessing task variability, she did not examine its relationship with structure.

Hrebiniak (1974) conceptualized technology as multidimensional. His six-item scale measured: (1) task predictability with Bell's (1965) items, (2) task interdependence with one of Mohr's (1971) items, and (3) task manageability with three of Mohr's (1971) questions. Hrebiniak found a significant relationship between technology and structure at the work-group level. However, it should be noted that Bell (1965, 1967), Mohr (1971) and Hrebiniak (1974) all included job discretion as part of their measure of technology, which appears to potentially confound the relationship between the structure and technology variables (Hunt and Near, 1980).

Van de Ven and Delbecq (1974) performed a more direct test of Perrow's (1967) theories, as they developed a contingent model of work-unit structure (modifying the matrix model of Grimes, et al., 1972). Their two dimensions of technology were task variability (based upon the number of exceptional cases encountered as in Perrow, 1967 and Hage and Aiken, 1969) and task difficulty (following Perrow's 1967 dimension of analyzability in the search process). Van de Ven and Delbecq (1974) found, from a sample of 120 subunits in a large employment security agency, support for a positive relationship between task difficulty and expertise. They also identified a direct influence by task variability, as well as interactive effects of both technology dimensions, on structure (measured in terms of the extent the specific "mode of operating" within a system was "systematized, discretionary of developmental"). They indicated that future research must evaluate

the effectiveness of work-units "structured in a certain manner given the kind of work they are undertaking."

The preceding works have provided a broad conceptual framework of technology (as opposed to frameworks which concentrate primarily on operations technology). In addition, they have indicated that technology is multidimensional, composed of certain task characteristics (i.e., predictability, variability, difficulty and interdependence). It has been shown that the subunit level (versus the system level) may prove to be the unit of analysis where we can best identify the relationship between technology and structure (e.g., Comstock and Scott). Hunt (1976) and Gerwin (1979) have provided some theoretical discussion concerning this issue. Furthermore, the need to evaluate the linkages between technology, structure and performance has been pointed out (Van de Ven and Delbecq, 1974). Finally, there is supporting evidence that we can successfully differentiate work-groups' tasks (technology) by measuring it in terms of Perrow's "cognitive" framework (i.e., by individuals' perceptions of their work). Hunt (1976) and Hunt and Near (1980) have provided a strong argument for focusing research attention on the cognitive processes, at the operator and work flow levels, in their discussion of "modeling." One of the primary postulates in this argument is that the key to the technology-organization connection may be the "cognitive burdens" imposed by tasks on the processes of organization planning and control, rather than by technology's effects on structure. This point will be developed in the following section, pertaining to organizational control processes and the linkage between technology and performance.

Appendix A identifies the major conceptual and empirical works on technology published since 1957. With respect to some of the major conceptual works, it summarizes several of the primary issues presented by the author(s). In addition, for the empirical works, it provides a description of the author's theoretical and operational definitions of technology, the type of organization studied and the level of analysis.

Organizational Control Processes and the Linkage Between Technology and Performance

Organizational control is possibly the most fundamental, yet least understood, of management activities. In a review of control theory literature, Giglioni and Bedeian (1974:292) suggested how control has been misunderstood in the following statement:

> Its (control) managerial role has often been mistakenly considered to be synonymous with financial control. In such a frame of reference, it has frequently been regarded as the sole domain of the accountant or comptroller and, in turn, completely equated with such techniques as budgets and financial ratios.

Moreover, even in the literature which recognizes control to be a primary managerial role beyond the strict financial meaning, structure and control have not always been clearly distinguished (Ouchi, 1977). In spite of these problems, there is a significant amount of literature which concerns the issues of organizational control in the framework of the present study (namely, how is it defined and what is its underlying nature, and what effects does the nature of control have on the organization?).

Many of the pioneer writers of management theory identified control as a specific function of management, but one which centered

primarily on the activity of "directing." Church (1914) considered control to be that function which coordinates all of the other functions of management and which supervises work. Diemer (1915) considered control to be the methods by which the executives carry out their authority to regulate the organization's affairs in accordance with organizational policies. Fayol (1949), identifying control as one of the five functions of management, considered it to mean the verification that everything conforms with the adopted plan and issued instructions.

The theorists following the early pioneers identified control as a process and suggested that planning was, in fact, an element of control. Davis (1940) identified control as the instruction and guideance of the organization as well as the direction and regulation of its activities. He specified routine planning as one of the eight subfunctions of control. Holden, et al. (1941) defined control as a process which included three elements: the setting of objectives, planning the implementation, and appraisal.

Modern theories of organization recognize that organization implies control; by characterizing an organization in terms of its pattern of control, we describe an essential and universal aspect of organization, which every member and group within it must face, and to which he must adjust. For example, Tannenbaum (1968) referred to control as any process in which a person, group of persons or organization determines (intentionally affects) the behavior of another person, group or organization. This description provides a general

definition which highlights one aspect of control, i.e., the direction of activities (Giglioni and Bedeian, 1974).

Various authors seem to have interpreted control as being equivalent to structure. For example, in the review of the technology literature presented earlier, it was pointed out that the most commonly used components of structure are differentiation or complexity, standardization, formalization and centralization (Ford and Slocum, 1977). With the possible exception of formalization (usually meaning the extent of rule usage), these components refer more to the form or configuration of the organization, and not to any managerial process. The authors, stressing these components of structure in relation to performance, presume that it is the structure which is "controlling." It should be noted that a basic premise being made in the present study is that the structure can often inhibit various managerial processes such as communication, decision making and even control. In this respect, structure and the process of control are not absolutely independent of one another; however, neither is structure equivalent to the process of control. Furthermore, as pointed out earlier, I agree with Thompson's (1967) and Woodward's (1970) assertions that technology influences structure, but that it is the processes of control and coordination which accompany the technology that have a direct effect on structure. In other words, structure and control may be associated, but structure does not "control" nor does it mean "control."

One of the first attempts to operationalize control is found in the works of Tannenbaum (1968, 1974) in his so-called control graph theory. Tannenbaum's control graph is a method for measuring the

degree of hierarchy in the organization and describes the exercise of power primarily at the system level. Tannenbaum's framework, however, does not explicitly treat control at the subunit level, nor does it examine any relationship between control and such variables as size and technology. In the research presented in Tannenbaum (1968), some insight has been given with respect to the consequences of control on performance and effectiveness. For example, Yuchtman (in Tannenbaum, 1968:127) states: ". . . although control may be both a cause and an effect of performance, we feel reasonably confident that in these organizations it is at least a cause."

Another conceptualization of control which warrants an examination is one which views control as an evaluation process. Ouchi and Maguire (1975) and Ouchi (1977) defined control as an evaluation process which is based on the monitoring and evaluation of behavior or of outputs. These authors specifically distinguish this definition of control from that of structure by asserting that structure consists of the familiar variables of centralization, and vertical and horizontal differentiation. Within their definition of control as an evaluation process, Ouchi and Maguire (1975) described the nature of control in terms of two "modes," behavior and output control. Behavior control is an evaluation process based on "personal surveillance" of an individual's work behavior. Output control is an evaluation process based on measurement of an individual's output. In their research, Ouchi and Maguire (1975) and Ouchi (1977) established that the variance in these control modes can be explained by task characteristics at the individual level of analysis, and by environmental

structural characteristics at the organizational level of analysis. However, they claimed that control is not an attribute of structure. Neither study investigated the potential effects of these two modes of control on performance. In a similar fashion, Dornbusch and Scott (1975:341) identified control as being distinct from structure and conceptualize control as an evaluation process in their statement: "Control over performers by evaluation of their performances on a task denotes the extent to which evaluations affect the direction and level of effort by performers on a task."

Woodward (1970) likewise included performance evaluation in her conceptualization of control. However, she also included some additional "prerequisite" elements which are worth examination. Specifically, Woodward's (1970) work referred to managerial control as "ensuring activities produce the desired results." Control, per se, is limited to the monitoring and evaluation of work. However, the process of control includes certain prerequisite elements, i.e., planning and setting standards. In Woodward (1970), the elements of "planning" and "setting standards" related specifically to setting the standards of work performance and defining the rules and procedures to be followed in guiding the accomplishment of the work. The inclusion of the elements of setting standards and planning under a conceptualization of control is not incongruent with the theories presented by various authors who claim a strong interdependence between planning and control (e.g., Thompson, 1967; Kast and Rosenzweig, 1969). In the present research study, Woodward's conceptualization of control, as just described, is adopted.

Within this conceptual framework, Woodward (1970) suggested that the nature of the control process can be depicted by two dimensions, labelled: (1) personal-mechanical, and (2) unitary-fragmented. The first dimension indicates the degree to which goals and work flow depend on individual (or personal) influence versus mechanical (or impersonal) influence. It appears from her work that this dimension is composed of such variables as the directness of control (or supervision in work), the extent of emphasis on rules guiding the work, and the extent of worker autonomy. It is suggested here that the "directness of control" and the "emphasis on rules" variables pertain to a single dimension which might be more appropriately labelled "the degree of personalization in exercising control." The third variable, extent of autonomy, would appear to be a separate dimension labelled "the degree of autonomy in exercising control."

Woodward's (1970) second dimension, i.e., unitary-fragmented, refers to the extent to which a well-integrated control system exists as opposed to a control system having multiple standards which may be inconsistent. Her work indicates that this dimension is composed of such variables as the quantity of standards to be attained, the compatibility between the standards and between the rules guiding the work, and the acceptance of both the standards and rules. This latter variable is also suggested by McMahon and Perritt (1971, 1973) in what they call "concordance" or the degree of agreement over the control structure. It is recommended here that a more appropriate label for Woodward's second dimension would be "the degree of unity in exercising control."

In the preceding context, control affects the behavior of organizational members and ultimately organizational performance. Let us briefly examine some of the theories linking control and performance. In terms of organizational control and the human element, Simon (1976) indicated that control is an implicit aspect of administration, which is essential in order to insure correct decision making as well as insuring effective action. Simon's theory recognizes that the organization takes some decisional autonomy from the individual, but the function of organizational control is not to correct "wrong decisions"; rather, it is to correct "bad decision making." In essence, Simon has made a distinction between control as a restriction of freedom, and control as a means to provide for even greater "rationality" and "efficiency."

The works of many other researchers also suggested that control is directly linked with such things as organizational climate, individual and group behavior, and performance. Biddle and Hutton (1976) advised that change, brought about by technology, influences the organizational climate as it poses a challenge (or perceived threat) to the "living space" that individuals and groups maintain for themselves in a work setting. This research gave added support to the "socio-technical" theories developed by the research of such authors as Trist and Bamforth (1951).

In Trist and Bamforth's conceptual framework, emphasis was placed on the primary work-group job design and the extent to which it fostered participation and self-realization through work. Trist and Bamforth (1951) argued that in order to optimize the technological

interface with organization, responsible "autonomy" must be restored to the primary work-groups as well as greater flexibility in the pace of work. They suggested that the superiority of the "composite" (versus "conventional") coal-getting system is that it better provides for the personal requirements of the miners and permits for more mutually supportive relations. This same concept (i.e., supportive relationship) is elaborated upon by Likert (1961).

Likert's principle of supportive relationships described the importance of how each subordinate perceives the contribution of his/her organizational experience (e.g., in terms of values, goals, expectations) or his/her sense of personal worth. Likert (1961) suggested that an essential prerequisite in one's experience is the capacity to exert upward influence (i.e., control) in order to facilitate the interactions which are essential to successful performance.

In addition to these preceding works, the association between certain aspects of control and human behavior, organizational climate, and performance are treated within such theoretical frameworks as social exchange theory, equity theory, reactance theory, and theories of operant conditioning (e.g., see Blau, 1964; Brehm, 1972; Davis and Cherns, 1975; Ouchi, 1978; Organ, 1974, 1977; Skinner, 1971; Susman, 1976).

Although the above examples demonstrate that a great deal of research and theory has been developed relating control to performance, we still lack a clear understanding of the relationship between characteristics of the work (technology) and the behavior of the workers as well as their performance. In addressing this question,

Woodward (1970) said that it is the nature of the control system (control referring to the task of ensuring that activities are producing desired results) which "links" technology to behavior (and performance). Woodward's (1970) new typology emerged from the premise that technology (the nature of tasks) can facilitate or can constrain individual behavior by its effects on the nature of control. Woodward (1970) proposed that the nature of the process of control is influenced by technological routineness, and that performance is influenced by the association (link) between technology and the control process. This framework, a technology-control process-performance linkage, is the one to be explicitly examined in this study in an effort to explain the "technology-organizational performance" relationship yet to be clarified by the research focusing on the context-structure connection.

Hunt (1976) provided a more precise theoretical explanation of how technology influences performance. He conjectured that the individual's task (at the operator level) is related to the technology required to complete it and that the organization's task (at the work flow level) is related to the technology essential for effective performance. Furthermore, since the work flow is, in essence, a matter of linking activities, i.e., integrating discrete tasks into a "purposively-oriented" system (Hunt, 1976; Jelinek, 1977; Gerwin, 1979), the ultimate performance of subunits is determined by the system which regulates and revises the work flow. This system (or process) which regulates and revises (i.e., establishes the standards, the rules and the procedures, monitors and evaluates) is the system

or process of organizational control. Performance is, therefore, influenced by the fit between the nature of the tasks performed and the nature of the control process essential to integrating tasks.

Ouchi (1977) also inferred that a focus on organizational control may be the "real" locus of the technology-organization relationship. Comstock and Scott (1977) theorized that the relationship might be more appropriately described at the individual and subunit levels of analysis. In this study the focus is at the subunit (workgroup) level of analysis.

In summary, based on the concepts developed by various authors, it is argued that organizational control refers to the process of ensuring activities produce desired results (Woodward, 1970; Ouchi, 1977; Dornbusch and Scott, 1977). Specifically, this process of control includes the setting of the standards of work performance, the rules and procedures to be followed in performing the work, and the monitoring and evaluation of work. There is a need to empirically delimit the underlying dimensions of the nature of the control process. Some of the major variables which have been described as those which constitute the nature of control are: the directness of control (or of supervision), the emphasis on rules which guide the work, worker autonomy, the quantity of standards of work performance, the compatibility between standards and between rules, and the acceptance of both the standards and the rules. Therefore, we need to determine how these variables are associated, in delineating the nature of organizational control processes.

A second issue concerns the need to examine the argument that the key to the technology-organization connection is that of a link between the nature of the tasks (based on the framework developed in the previous literature review section), and the nature of organizational control processes. A third issue is the need to examine the link between technology (the nature of the tasks), and the nature of organizational control processes and performance.

Performance

Before describing the specific hypotheses of this study it is helpful to review literature pertinent to the conceptualization and operationalization of performance. The literature which considers performance (effectiveness) in the framework of a technology-organization connection generally focuses on the organization as the unit of analysis. Among these studies, economic or financial measures of performance are most frequently used. Such measures provide limited use when the evaluation concerns service-type organizations, and/or where the investigation focuses upon comparisons between organizations or subunits which are diversified in terms of such aspects as purpose or function.

In general, the organizational effectiveness literature has been described as being noncumulative in nature (e.g., Mott, 1972; Steers, 1977; and Goodman, et al., 1979). A variety of reasons for this have been put forth, including problems in defining and identifying the domain of performance, and general disagreement in describing the nature of organizations (i.e., the differences between the goal-

optimization, systems and behavioral perspectives). For these reasons, research strategies have varied, resulting in the lack of a coherent, consistent conceptualization of performance (or effectiveness).

In searching for a rational approach to evaluating performance, certain objectives were established for this study. First, the approach to evaluating performance must not be so broad in focus to preclude specifying the domain of performance. Second, the approach cannot be so narrow we would not be able to apply it in comparing heterogeneous units. Third, the approach to evaluating performance must be compatible with our model of the organization (or subunits) and how organizations function; i.e., it must be congruent with an open-systems perspective. With respect to this latter point, the open-system approach views the organization-environment relationship as a crucial element. The organization's (and subunit's) processes cannot merely center on direct productivity at the expense of such dimensions as adaptability (and innovation), flexibility, and an ability to anticipate problems and changes.

Several sources (e.g., Steers, 1979; Goodman and Pennings, 1979) provide rather comprehensive reviews and analyses of the organizational effectiveness literature. Although various theorists recommend tailoring concepts of effectiveness to each type of organization, there is ample justification to argue for the need to search for criteria of effectiveness appropriate across organizational-types and settings. There are many well-recognized studies which, on the surface, appear to have widely divergent definitions of effectiveness, yet which share several critical criteria of effectiveness. For

example, the criteria of adaptiveness, innovation, flexibility, successful utilization of resources and productivity were utilized in part by Georgopoulous and Tannenbaum (1957), Bennis (1962), Yuchtman and Seashore (1967), Friedlander and Pickle (1968), Price (1968), Mahoney and Weitzel (1969), Schein (1970), Duncan (1973), Mott (1972), Campbell (1973), Webb (1974), and Campbell, et al. (1974). The unit of analysis across these studies varied as well as the type and size of the unit under analysis. One of these studies, Mott (1972), developed an operational definition of effectiveness (or performance) which is very compatible with this study's objectives.

Mott (1972) described effectiveness as "the ability of an organization to mobilize its centers of power for action--production and adaptation." The major underlying dimensions of effectiveness operationalized by Mott included: productivity, adaptability and flexibility. Productivity consists of quantity, quality and efficiency components. Adaptability and flexibility include the ability to anticipate problems and changes, keep up to date, and adjust promptly to changes. These dimensions or criteria of effectiveness were viewed by Mott (1972) and others as applicable across organizational units. Moreover, they are dimensions which are critical to subunits within organizations. For these reasons Mott's (1972) conceptualization of performance is adopted in this study.

Research Hypotheses

By way of introducing the research hypotheses, I refer again to the previously stated purposes of this study. First, I seek to

delineate the underlying dimensions of the nature of organizational control processes, defined in general terms as the process of ensuring that activities produce desired results. According to Woodward (1970) this process refers to: (1) certain prerequisite activities, i.e., the setting of standards of work performance, the setting of rules and procedures; and (2) the act of monitoring and evaluating work. Furthermore, the literature identifies some major variables which constitute the nature of control. These are: the directness of supervision, emphasis on rules, autonomy, quantity of standards, the compatibility between standards and between rules, and the acceptance of standards. Woodward (1970) suggested that two dimensions delineate the nature of the control process, "personal-mechanical" and "unitary-fragmented." In addition to these two (which are relabelled here), I proposed earlier that a third dimension may be represented--degree of autonomy. To date, no empirical delineation of the dimensions of the nature of control has been accomplished. Therefore, using the variables described by Woodward (1970), the following hypothesis is presented:

> H_1: *The nature of organizational control processes can be functionally comprised of three independent dimensions: the degree of personalization in exercising control (ranging from personal to impersonal), the degree of unity in exercising control (ranging from united to disunited), and the degree of autonomy given in exercising control (ranging from low to high).*

The second purpose is to examine and test the strength of the relationship between technology and the nature of organizational control processes. The literature pertaining to a technology (versus size) structure connection has provided inconsistent findings. Additionally, some authors (e.g., Hunt and Near, 1980) claimed that the technology-organization relationship might still be inappropriately conceptualized, suggesting the focus should be placed on a technology-control connection. Furthermore, the technology framework described in the works of such authors as Perrow (1967), Hunt (1976), Comstock and Scott (1977), and Hunt and Near (1980) intimate that the key to the technology-organization connection may be one resulting from the "cognitive burdens" imposed by "tasks" on the process of planning and control. This "cognitive" interpretation of technology focuses on various aspects of the tasks as perceived by the worker, i.e., task variability, predictability, difficulty and interdependence (all of which indicate the routineness of tasks). In this same context, Woodward (1970) suggested that the nature of the control process is influenced by technological routineness. However, to date, no empirical investigation of this conceptualization has been made. Finally, the literature encourages emphasis on technology and control at the operator and/or subunit levels. In this context, the following hypothesis is presented:

> H_2: *Within organizational subunits of similar size, technology will explain a significant amount of the variance in the nature of the control process.*

The third purpose is to examine and test the strength of the relationship between technology, the nature of the control process, and performance. Based upon some of the same literature identified in the preceding paragraphs (e.g., Woodward, 1970; Hunt and Near, 1980), it is suggested that performance is influenced by the relationship between technology (the nature of the tasks) and the nature of the control process rather than by technology directly. Once again, the influence might best be depicted at the level of the operator and/or the work flow. Therefore, the following hypothesis is presented:

> H_3: *Within organizational subunits of similar size, more variance in performance will be explained by the indirect effects of technology, mediated by the nature of the control process, than by the direct effects of technology.*

CHAPTER II

RESEARCH METHODOLOGY

General Design

Unlike some previous comparative theories which centered on the relationships between certain contextual variables and intra-organizational variables at the system level, the framework of this study emphasizes the tasks done throughout an organization and the manner by which the organization ensures that the activities at the subunit level are producing desired results. The variables of primary interest are job technology and the managerial control process, although there is also concern for controlling the effects of size and, to some extent, the environment (the other major contextual variables). Toward this end, this study shall concentrate on subunits (work-groups) from a single organization, where environmental differences among work-groups are assumed to be minimal. The nature of the data gathered is cross-sectional; a questionnaire method was used to measure the variables of interest. The major methods of data analysis employed are factor analysis and multiple regression analysis.

Sample

The data for this research were collected from full-time staff employees (excluding supervisors) of the 70 work-groups within one

large educational organization in the United States Air Force. This organization is responsible for providing undergraduate and graduate level education, professional continuing education, specialized training, research and consulting for the U.S. Air Force. The areas of education include scientific, technological, managerial, medical and other fields. The organization has existed for over 60 years.

One of the major reasons for selecting this organization was that it is a service-type (i.e., educational) organization. To date, very little empirical emphasis in the area of organizational technology has been given to service-type organizations. Another important reason for selecting this organization was that it has an adequate number of work-groups for this research and they vary in size from one to 25 full-time staff employees. Furthermore, the work-groups all appeared to be operating within a similar organizational environment, in terms of such aspects as environmental uncertainty and complexity. Finally, the work-groups provide a variety of distinct services to the organization as a whole. In so doing, the researcher determined *a priori* that the "technologies" across the 70 work-groups varied significantly; this variance in technology was an important requirement for testing the hypotheses.

The 70 work-groups within the organization range in size from one to 25 full-time staff employees. Over 20 of these work-groups consist mainly of faculty members, directly providing the educational, research, and consulting services. The remainder of the work-groups primarily provide the support services typical of many higher educational institutions. These services include: research,

development and consulting support; admissions; administration; resources management (e.g., computer support, financial planning and budgeting), library support, and personnel management.

There are a total of 395 full-time employees (excluding supervisors) in these 70 work-groups. The data was collected by performing a survey of all 395 employees (full-time staff employees in all the organization's work-groups). Of the 395 employees, 279 (71 percent response rate) voluntarily completed the questionnaire. The response rate for the 70 work-groups ranged from 50 to 100 percent. The 279 respondents consisted of approximately 41 percent military officers, 17 percent military enlisted, and 42 percent federally employed civilians. Approximately 81 percent of the respondents were male and 19 percent female. The educational composition of the respondents was: 19 percent high-school graduates, 25 percent less than four years of college, 9 percent bachelor's degrees, 30 percent master's degrees, and 17 percent doctoral degrees.

The organization, work-groups and all the individuals of the organization were guaranteed anonymity. Therefore, no direct reference will be made to the official names of any work-group or of the organization itself.

Research Instrument

Data was collected by the administration of a 100-item questionnaire to all full-time staff members (excluding work-group supervisors) of the organization's 70 work-groups. The questionnaire consists of items which measure the nature of organizational technology,

the nature of the control process and work-group performance. Also included in the questionnaire are background information items and items measuring job satisfaction (these were included for possible use in follow-on research).

The questionnaire is provided in Appendix B. All items, with the exception of the background information statements, are answered on a seven-point, Likert-type scale. Within most of the indices (or scales) several of the items are negatively-worded. Before the analysis was performed, these negatively-worded items were reverse scored so that when the respective scale score was computed there would be a consistent indication between a high/low scale score and a high/low measure of the dimension. The following paragraphs provide a general discussion of the major measures included in the research instrument. A more detailed explanation of the operationalization of these measures is provided in a later section of this chapter.

The questionnaire items which measure technology (the first section of the questionnaire) and those measuring the nature of the control process (the third section of the questionnaire) correspond to the previously discussed theoretical frameworks and empirical research. Selecting questionnaire items for operationalizing the indices of technology was based primarily on those studies using Perrow's (1967) framework. Many of those studies' items are adopted without change. Selecting items for operationalizing the nature of control processes was based primarily on the conceptualizations of Woodward (1970) and Ouchi and Maguire (1975). Also, some of the items

pertaining to the extent of rule usage and the extent of autonomy were selected from Lynch (1972).

The questionnaire items used to measure performance (the second section of the questionnaire) were based on the conceptualization of Mott (1972); similar measures have been employed in a variety of large field studies (e.g., Hendrix and Halverson, 1979). The questionnaire items used to measure job satisfaction were based on the work of Andrews and Withey (1976). These items were included for gathering data for follow-on research. The final section of the questionnaire consists of 15 questions which all pertain to demographic (background) information.

The front of the questionnaire contains: (1) a "Privacy Act Statement"--a requirement for any survey being administered to Department of the Air Force employees, and (2) introductory and instructional information. The introductory information briefly describes the purpose of the research, emphasizes that the individual's data will be held in confidence and provides the respondent with the name and address of the researcher. The instructional information defines certain key terms (i.e., supervisor, work-group and organization), and explains how the questionnaire is to be completed. Each questionnaire packet included two "machine-scored" answer sheets on which all questionnaire answers were to be marked. All questionnaires and answer sheets were visually inspected before administration to be sure that each respondent would have a complete and "unmarked" set.

Finally, attached to the front of each questionnaire was a letter signed by the organization's "Chief of Staff" (second-in-

command). The letter provided a brief explanation of the research effort, emphasized the voluntary nature of individual participation, and endorsed the researcher's request for maximum cooperation in completing the survey.

All the questionnaire items were screened for format, length, clarity and understanding. A preliminary questionnaire was designed and distributed to doctoral students and faculty members, who were familiar with the concepts of the research, and of questionnaires in general. They were asked to suggest revisions based upon questions they found ambiguous, redundant, or irrelevant. On the basis of their comments the final form of the questionnaire was designed.

Questionnaire Administration

The questionnaire was administered to all full-time staff employees over a three-day time frame. The questionnaires were distributed personally by the researcher to each work-group. The researcher visited each work-group supervisor the week prior to distributing the questionnaires. During this visit, the researcher explained the purpose of the research, the voluntary nature of individual participation, the anonymous nature of the data, and assured the supervisor that all the data would be held in the strictest confidence. At that time, the researcher requested the supervisor's permission to personally distribute the questionnaires to his/her employees during the following week. Every supervisor approved the request. On the following week the researcher hand-carried, to each work-group setting, a set of sealed questionnaire packets (equal in

number to the number of full-time staff employees in each respective work-group). The packets were handed to each employee in a random fashion. In fact, the researcher made a point of indicating to each employee that no packet was specifically designated for that employee.

Each packet included: (1) a stamped, self-addressed (researcher's office address) return envelope; (2) the questionnaire, which included the organization's "Chief of Staff" cover letter (described earlier) and the researcher's introductory information; and (3) two blank 80-question, machine-scored ("OPSCAN") response sheets. Two 80-question response sheets were necessary since the questionnaire consisted of 100 total items. Each response sheet was precoded with a three-digit number from 001 to 395. The respondents were instructed that this coded number was only used to account for all the distributed packets. The researcher did, however, designate a specific series of numbers for each work-group. In this manner, the researcher was able to trace and group the returned response sheets by work-group--an essential requirement for the research design.

Measures

Operationalization of Technology

Technology, defined in terms of the routineness of the tasks performed within subunits, was measured by means of four hypothesized indices from existing scales as well as a few new items. The four indices are shown in Section I of Appendix C.

The first index measures both the predictability and variability of tasks, emphasizing Perrow's (1967) concepts of the number

of exceptional cases encountered in the work and the degree to which search procedures (when exceptions are encountered) are analyzable. Each respondent is asked to indicate how he/she perceives these two aspects in the tasks with reference to their job in the subunit. Items were developed from the studies of Hage and Aiken (1969), Perrow (1970), Magnusen (1970), Lynch (1972, 1974), and Van de Ven and Delbecq (1974). There are 15 items in this scale. A high score on this scale (after certain items are reverse-scored) reflects high predictability and low variability, which will indicate high task routineness.

The second index measures the difficulty of tasks, based on the concepts developed by Perrow (1967) and the scales described in Mohr (1971) and in Van de Ven and Delbecq (1974). Task difficulty (or complexity) refers to the extent to which there are known procedures specifying the sequence of steps to be followed in performing the task. Each respondent is asked how he/she perceives this aspect of the tasks with reference to their job in the subunit. There are 13 items in this scale. A high score on this scale (after certain items are reverse-scored) reflects low difficulty, which will indicate high task routineness.

The third index measures the interdependence of tasks, based on the concepts and scales described in Mohr (1971), Lynch (1972, 1974) and Overton, et al. (1977). Task interdependence refers to both the intra- and inter-subunit interdependence among tasks performed by the individuals. Each respondent was asked to indicate to what extent others' tasks depend on his/her own task performance. There are six

items in this scale. A high score on this scale (after certain items are reverse-scored) reflects low interdependence which will indicate high task routineness.

The fourth index measures the nature of the production process with respect to Woodward's (1965) notions of the degree to which the product/service is standardized and the degree to which the process of production is complex. The items were developed from Woodward's (1965) concepts and items described in Lynch (1972). There are four items in this scale. A high score on this scale reflects high standardization of product/service and low complexity of the production process. This indicates high task routineness. Based on Woodward's (1970) framework, it is expected that technological routineness will explain a significant amount of the variance in the nature of organizational control processes.

Operationalization of the Nature of Control

Organizational control is defined in general terms as the nature by which an organization ensures that its activities produce the desired results. More specifically, Woodward's (1970) conceptual framework has been adopted here. Woodward's framework depicts the nature of the control process in terms of several variables which she suggests constitute two basic dimensions, labelled the "personal-mechanical" and "unitary-fragmented." In this study, it has been proposed that the variables described in Woodward (1970) constitute three dimensions, which will be explicitly tested. The specific

hypothesized dimensions with their respective indices (scales measuring the variables described in Woodward, 1970) are shown in Section III of Appendix C.

The first two indices (see Appendix C, Section III, Part One) are measures of the hypothesized dimension labelled the "degree of personalization in exercising control" (similar to Woodward's "personal-mechanical" dimension which was described earlier). The first of these indices measures the extent to which the behavior of an individual on the job is controlled directly (i.e., direct supervision and guidance). In other words, the respondents are asked to indicate the extent to which the guidance, direction and evaluation he/she receives is provided directly from a supervisor. There are three items in this scale. A high score on this scale (after certain items are reverse-scored) reflects high direct control, which indicates a high degree of personalization in exercising control.

The second index, measuring the "degree of personalization in exercising control," is a scale indicating the extent of emphasis on rule usage. This refers to the degree to which an individual's work activities are guided and directed by formal, written policies, rules and procedures. These items were developed from the works of Lynch (1972) and Hrebiniak (1974). There are three items in this scale. A high score on this scale (after certain items are reverse-scored) reflects low emphasis on rule usage, which indicates a high degree of personalization in exercising control. According to the

theoretical formulation of Woodward (1970), it would be expected that technological routineness and the degree of personalization in exercising control are inversely related.

The next three indices (see Appendix C, Section III, Part Two) are measures of the hypothesized dimension labelled the "degree of unity in exercising control" (similar to Woodward's "unitary-fragmented" dimension which was described earlier). The first of these indices measures the extent of formal standards of work performance applicable to an individual's job. Formal standards of work performance refer to the specifications which prescribe the quantity and/or the quality of output to be attained by workers in their jobs. It is expected that the greater the quantity of these standards, the greater the burden on the individual to adequately satisfy all demands. In this respect, the greater the number of standards placed on each individual, the greater the potential for disunited control in that each individual may begin to adopt his/her scheme of setting priorities in the work and/or his/her own specification levels. There are three items in this scale. A high score on this scale (after items are reverse-scored) reflects a low quantity of standards, which indicates a high degree of unity in exercising control.

The second index, measuring the "degree of unity in exercising control," is a scale indicating the extent of compatibility between the formal standards of work performance and between the rules/procedures which guide the work itself. The formal standards of work performance refers to the specifications which prescribe the quantity and/or quality of output to be attained. The rules and procedures

refer to the guiding policies, directives, etc. which prescribe the manner by which work will be performed and prescribe the desired behavior of organizational members in their job. There are seven items in this scale. A high score on this scale (after certain items are reverse-scored) reflects a high degree of compatibility between standards and between rules/procedures, which indicates a high degree of unity in exercising control.

The third index, measuring the "degree of unity in exercising control," is a scale indicating the extent of acceptance of both the formal standards of work performance and the rules/procedures. The formal standards of work performance refers to the specifications which prescribe the quantity and/or the quality of output to be attained. The rules and procedures refers to the guiding policies, directives, etc. which prescribe the manner by which work will be performed and prescribe the desired behavior of organizational members in their job. Each respondent is asked to indicate to what extent he accepts, is committed to, and feels challenged by, the standards and procedures. It is expected that general acceptance of standards and rules is an indication of greater unity in the exercise of control. There are seven items in this scale. A high score on this scale (after certain items are reverse-scored) reflects a high degree of acceptance of both the standards and rules/procedures, which indicates a high degree of unity in exercising control.

According to the theoretical formulations of Woodward (1970), it would be expected that extremely high and low technological

routineness is positively associated with high unity in exercising control.

The sixth index pertaining to control processes measures the hypothesized dimension labelled autonomy/discretion (see Appendix C, Section III, Part Three). The items in this index measure the extent of autonomy in the work as perceived by the respondent. Specifically, this scale accentuates the extent of autonomy the individual has in determining how to proceed with the tasks (e.g., the pace and sequence of performing the tasks). Most of the items were developed from the works of Lynch (1972) and Hrebiniak (1974). There are eight items in this scale. A high score on this scale (after certain items are reverse-scored) indicates a high degree of autonomy/discretion. Based on the formulation of Woodward (1970), it would be expected that technological routineness is inversely related to the degree of autonomy.

The final index pertaining to control processes measures the two modes of control (behavior and output) suggested by Ouchi and Maguire (1975). This measure was included in the study in order to determine what association, if any, these "modes" of control have with the other variables of control (i.e., those previously operationalized). These "modes" were not included in this study's hypothesis pertaining to the nature of control (i.e., H_1), since it was expected that they would be indicators of "what" is controlled, rather than indicators of "how" control is exercised (which is the focus of this study). Specifically, "behavior" control refers to a monitoring or an evaluation of the individual's behavior on the job, i.e., how he/she is proceeding in the work. "Output" control refers to an evaluation of the

final output of the work. The four items in this scale are slightly modified versions of those described in Ouchi and Maguire (1975). A high score on this scale (after certain items are reverse-scored) indicates high emphasis on behavior (vis-à-vis output) control.

Operationalization of Performance

Performance, conceptualized in terms of a unit's ability to mobilize its centers of power for action (productivity and adaptability), was measured using a seven-item index. This index, shown in Appendix C, Section II, measures various criteria of performance including: quantity and quality of output, efficiency (in the utilization of resources), ability to anticipate problems and changes, flexibility and adaptability. These items were developed from those used by Mott (1972) and Hendrix and Halverson (1979). Each respondent was asked to indicate his assessment of his respective work-group on these criteria. High scores reflect high perceived work-group performance.

Operationalization of Job Satisfaction

As previously stated, job satisfaction was not treated in the analysis of this study. However, data was gathered on this dimension for possible use in future research. The scale used to measure job satisfaction is shown in Section IV of Appendix C.

Briefly, the scale used is the "Job Index" of Andrews and Withey (1975). This index consists of five items which measure satisfaction with different aspects of the job (e.g., co-workers, the work itself, general work environment). The scale has been found to have an alpha coefficient of .81.

Operationalization of Size

As stated previously, the unit of analysis in this study is the subunit. Size is treated as a potential extraneous variable. Size is defined in this study as the number of full-time staff employees in each subunit. This is the most commonly used operational definition of size in the literature reviewed, particularly within those studies which focused on the subunit level. These data were obtained from the organizational records of appropriate officials within the organization.

Aggregation of Individual Responses

The unit of analysis in the tests of hypotheses two and three (H_2 and H_3) was the work-group. As described earlier, the researcher used a numerical code for each work-group in order to be able to classify individual response sheets by work-group. For purposes of aggregation, a simple mean of all respondents' scores for each work-group on each variable analyzed was computed. As will be described shortly, the questionnaire scale items for technology, control and performance were all factor analyzed. Factor analysis was performed on the "control" variable(s) as the test of hypothesis one (H_1). Factor analysis was performed on the technology and performance variables as the method of validating these respective constructs. Therefore, after these factor analyses were performed (on the technology, control and performance variables), and in preparation for testing the second and third hypotheses, "factor scores" were computed for each respondent on each factor. The aggregation (to the

work-group level) was accomplished by computing a simple mean of all respondents' (within each respective work-group) "factor scores" for each factor.

Different aggregation methods have been used by various authors, based primarily on the fact that investigators of organizational technology have selected their respondents differently and have made some attempt to account for differences in respondents when aggregating to the subunit or organizational level. For the most part, differential weighting is applied to account for such things as differences among supervisory and nonsupervisory respondents, managerial and nonmangerial positions and other "social position" differences (e.g., Hage and Aiken, 1969; Van de Ven and Delbecq, 1974). We have decided to use the simple mean method of aggregation for three reasons: first, one questionnaire (measuring technology and control) will be administered to all subunit full-time staff employees excluding the subunit manager or supervisor. Second, the number of different major activities for which any one subunit is responsible is not exceedingly large. Because of this homogeneity of specialization within subunits, the technology and control dimensions would not be expected to vary excessively within a subunit--a problem which might bias the scores in favor of those tasks occurring more frequently. Third, we have designed the wording and phraseology of all questionnaire items in such a way as to give each respondent the same point of reference (i.e., the individual's tasks and personal behavior).

Validity of Technology and Performance Constructs

This section concentrates on a description of the method of construct validation used for technology and performance. Since hypothesis one concerns, in part, the construct validation of "control processes," (the other major variable in this study), we will defer a discussion of validating the "control" construct to a later section of this chapter.

Independent factor analyses were performed on the measures of technology and performance for purposes of validating these constructs and, if possible, reducing the larger number of measures to a smaller number. Factor analysis is perhaps the most powerful method of construct validation (Kerlinger, 1973). In this regard, it is frequently used to discover which measures (among some set of multiple measures of some construct) go together, or measure the same thing, and to assess the relations between the clusters of measures that go together.

An ideal situation would have been to develop additional, empirically-based, external measures of technology, performance and, for that matter, control, which could be used to perform a criterion-related validation (e.g., see Kerlinger, 1973). However, with respect to this study's sample and, with respect to the measurement of technology and control in general, there are no empirically-based, external measures that could have been used with any confidence to validate these questionnaire measures. Furthermore, as described earlier, there is little consensus in the field of organization theory concerning the domains (definitions) of these constructs. However, of

particular importance to construct validation is that if items (measures) within a construct (e.g., technology, control or performance) measure a common "subconstruct," they shou... relate higher with each other and converge together into a common factor.

As described earlier, the questionnaire consists of 38 items, grouped initially into four scales, which measure various components of technology, and seven items which measure various criteria of workgroup performance. For the technology construct, the scales developed are: (1) task predictability and variability, which resembles the measures of technology used by such authors as Hage and Aiken (1969) and Lynch (1974); (2) task difficulty, which resembles the measures used by such authors as Perrow (1970b), and Van de Ven and Delbecq (1974; (3) task interdependence, which resembles the measures of technology used by Lynch (1974); and (4) product or service standardization, which is based on Woodward's (1965) concepts of technology. For the performance construct, the seven items resemble the measures of performance criteria of Mott (1972) and Hendrix and Halverson (1979). Each item pertains to a specific criterion deemed critical to performance; however, it is expected that these criteria would go together to form a single construct of performance.

Factor analysis was performed by means of the SPSS factor program (Nie, et al., 1975). The specific SPSS factoring method used was principal factoring with iteration (which employs an iteration procedure for improving the estimates of communality). Orthogonal ROTATION (using the VARIMAX criterion) was employed. Specific objectives for factoring were defined beforehand by the researcher. First,

the final factor solution would consist of only those factors which have a sufficient number of high factor loadings to enable clear identification of each fact . Second, the final factor solution would attempt to account for as many of the original items as possible, while at the same time attempting to identify clear and independent factors. In other words, the goal is to explain as much of the "common variance" as possible, while trying to validate the independence among possible "subconstructs" (factors, dimensions or scales). In an attempt to achieve these two objectives, the following criteria were used. First, a minimum factor loading of .40 was used to associate a variable (item) with a given factor. Second, a minimum of two to three items per factor (with high loadings) were essential to define a factor. Third, eigenvalues greater than or equal to one (1.0) were used to determine the number of factors which could best explain the common variance. This criterion is a convention established by Kaiser for identification of the number of factors that provide a "reliable and meaningful" explanation of the common variance (Harman, 1967). The results of these analyses, i.e., validating the technology and performance constructs, are presented in the next chapter.

Reliability of the Scales

Reliability estimates, based on coefficient alpha (Cronbach, 1951), were obtained to evaluate the internal consistency of the items within each scale (resulting from the factor analyses) of technology, control, and performance. Coefficient alpha pertains to the detection of measurement error resulting from a lack of internal

consistency in response to the items in an index. It sets an upper limit to the measure of reliability; thus, if a low coefficient alpha is obtained, the items the index measures have little in common or the index is too short (Nunnally, 1967). Also, coefficient alpha proves to be a good estimate of reliability in most situations, since the major source of measurement error is because of sampling of content, and reliability estimates based upon internal consistency consider other sources of error such as those based on the sampling of situational factors accompanying the items (Nunnally, 1967). Computations for evaluating the scales were accomplished by means of SPSS Subprogram RELIABILITY (Nie, et al., 1975). The results of these analyses are reported in the next chapter.

Data Analysis

This section will describe the two methods of analysis used in this study: (1) factor analysis, which was used to test the first hypothesis; and (2) multiple regression analysis, which was used to test hypotheses two and three.

Factor Analysis and Hypothesis One (H_1)

Factor analysis was used to test hypothesis one, which concerns the attempt to delineate the nature (the underlying dimensions) of organizational control processes. Factor analysis is commonly used to search for and identify, among a set of variables assumed to represent multiple dimensions, the orthogonal dimensions which best account for the common variance. This process assumes that the variance is

not all error and specific variance (Harman, 1967; Kerlinger, 1973; Nie, et al., 1975).

Nie, et al. (1975) proposed that the most frequent applications of factor analysis fall into one of three categories: (1) exploratory uses--to explore and detect the patterning of variables as a means of data reduction and the discovery of new concepts; (2) confirmatory uses--to test hypotheses about the structuring of variables within identifiable dimensions; and (3) as a measuring device--to construct indices to be used as new variables in later analyses. In essence, this study is concerned primarily with all three applications, though the second pertains directly to testing the first hypothesis.

In order to test hypothesis one, the data from the questionnaire measures of the control process variables were factor analyzed using the SPSS factor analysis program outlined in Nie, et al. (1975). The control process data consisted of all individuals' (N=279) responses to the 35 questionnaire items (described earlier--see Appendix C, Section III). Each item was measured on a seven-point Likert-type scale. Three general objectives for factoring were established for this study: (1) to select only those factors which have a sufficient number of items with high factor loadings on it (to permit clear identification of the respective factors), (2) to select the minimum number of factors which capture as much of the common variance as possible, while maintaining clear independence between factors, and (3) to account for as many items as possible. In order to satisfy these objectives, two criteria were established. First, each factor selected should have a minimum of two to three items with high

loadings (.4 or greater was used), in order to permit clear identification of each factor. Second, the factor eigenvalues must be greater than or equal to one (1.0) to determine the number of factors that can best explain the common variance. As described earlier, this criterion is a convention established by Kaiser for identifying the number of factors that provide a "reliable and meaningful" explanation of the common variance (Harman, 1967).

A thorough review of the entire data base revealed that there was no missing data (with the exception of some of the "Background Information" questions) for any of the 279 cases (individual respondents). Therefore, the treatment of "missing values" was not an issue in any of the analyses performed.

The specific SPSS factoring method used was principal factoring with iteration (Nie, et al., 1975). Orthogonal rotation, using the SPSS VARIMAX criterion, was used to search for independence between factors.

Various iterations of the factor analysis were performed in search of the best possible factor solution according to the criteria described earlier. During the process of evaluating each factor solution, careful attention was given to identifying variables which would not "load" on any factor. These variables were eliminated one at a time in arriving at the final factor solution.

Based on the final factor solution, scales were developed and labelled based on the highest loading variables within each factor. The labelling of each factor took into account the magnitude and the direction (positive or negative value) of the respective variable

loadings as well as the nature of the "scoring" of each variable (i.e., whether it was "reverse-scored"). Reliability estimates, based on coefficient alpha (Cronbach, 1951) were obtained on each scale (each factor) in the final factor solution. Coefficient alpha was described earlier in this chapter.

Finally, using as a basis the final factor solution, factor scores were derived for each case on each of the final solution factors. A factor score is a composite score, i.e., a case score for each factor, which can be used in other analyses. In this study, the factor scores generated were used in the analyses to test hypotheses two and three. For this same reason, factor scores were also generated from the final factor solutions of both the technology and performance constructs. The factor analyses of technology and performance outlined earlier were performed for the purpose of construct validation. The results of the factor analyses of control and the reliability estimates of the scales are presented in the next chapter.

Multiple Regression and Hypotheses Two and Three (H_2 and H_3)

Multiple regression was used to test the second and third hypotheses. Hypothesis two centers on determining whether or not technology explains a significant amount of the variance in the nature of the control process within subunits (work-groups) of similar size. Hypothesis three focuses on determining whether or not more variance in performance is explained by the indirect effects of technology (i.e., as mediated by the nature of control) than by the direct effects within work-groups of similar size. As a descriptive tool, the most

important uses of multiple regression, according to Nie, et al. (1975) are: (1) to find the best linear prediction equation and evaluate its prediction accuracy, (2) to control for other confounding factors in order to evaluate the contribution of a specific variable or set of variables, and (3) to find structural relations and provide explanations for seemingly complex multivariate relationships. In testing hypotheses two and three, the focus of our analyses was on the second application. The specific data for these analyses were generated from the factor scores described in the preceding section. Since the unit of analysis for hypotheses two and three was the work-group, it was necessary to aggregate the factor scores for each technology, control and performance factor. Each individual's (respondent's) data had been collected using a numerical code in order that all individuals' responses could be accurately tied to their respective work-groups. Therefore, all the individuals' factor scores were aggregated by their respective work-groups. The process of aggregation and reasoning behind the use of a simple mean of respective work-group members' factor scores was described earlier in this chapter. The total number of work-groups for the analyses of hypotheses two and three was 70.

The regression analyses utilized the SPSS multiple regression program outlined in Nie, et al. (1975). The regression design employed both the hierarchical and stepwise methods (see Nie, et al., 1975). The hierarchical method permits the researcher to specify the order of inclusion of the variables. The stepwise method allows the variables to be entered in the order of their respective contribution to

the explained variance of the dependent variable. The succeeding paragraphs of this section describe the regression analysis performed to test hypotheses two and three, one at a time.

The test of hypothesis two controlled for the effects of work-group size and evaluated the amount of variance in the nature of the control process explained by technology. Figure 2 depicts the three key "links" being evaluated in this study. The link labelled "a" is the focus of hypothesis two.

In testing hypothesis two, a separate regression was performed on each control process dimension (or factor) which was identified during the factor analysis process (i.e., testing hypothesis one). In other words, each control process factor was treated as a separate "dependent" variable in the regression test of hypothesis two. In each of these regressions, the work-group size variable was entered into the regression equation first, using the hierarchical method. This was accomplished in order to control for the effects of this variable. Then, the various job technology factors (the independent variables) were entered into the equation using the stepwise method. In this manner, clarity was achieved vis-à-vis the amount of variance explained by each job technology variable with respect to each control process variable. The specific tests, within each of the separate regressions, were performed on the regression coefficient of each independent variable. Specifically, an "F" test of each regression coefficient was performed using .05 as the statistical level of significance.

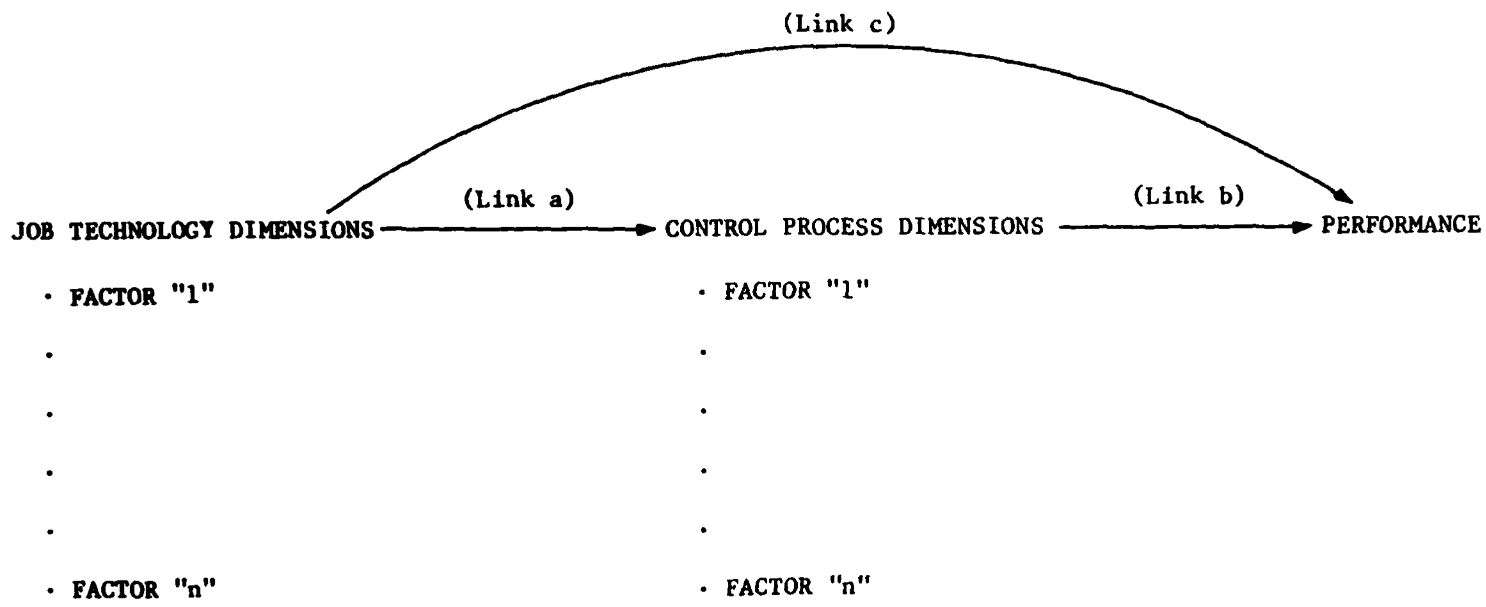

Fig. 2. Job Technology-Managerial Control Process-Performance Links

The test of hypothesis three controlled for the effects of size and evaluated the amount of variance in performance explained by job technology directly and indirectly (i.e., mediated by the control process variables). This hypothesis posits that more of the variance in performance is explained by technology, mediated by control, than by technology directly. In reference to Figure 2, this hypothesis posits that the "ab" linkage will be greater than the "c" link.

In order to test hypothesis three, three sets of regression coefficients were needed. First, it was necessary to have the job technology variables' regression coefficients for the link labelled "a" in Figure 2. These were the same ones computed and analyzed in testing hypothesis two. Second, we needed the control process variables' regression coefficients for the link labelled "b" in Figure 2. In this situation, performance was the dependent variable and the work-group size and job technology variables were controlled. In computing these coefficients, size and each job technology variable were entered into the equation first, using the hierarchical method, followed by each of the control process variables, using the stepwise method. The third set of coefficients necessary was the job technology variables' regression coefficients for the link labelled "c" in Figure 2. In this instance, performance was the dependent variable and the work-group size and control process variables were controlled. In computing these coefficients, size and each control process variable were entered into the equation first (using the hierarchical method),

followed by each of the job technology variables (using the stepwise method).

Since, as aforementioned, there were multiple versions of link "a" (one for each control process factor or variable), it was requisite to compute every possible version of the "ab" linkage and compare each of these to the "c" link. The analysis performed was one of comparing the standardized regression coefficient (Beta) of the direct link ("c") to the product of the Beta coefficients from the indirect linkage ("ab"). Hypothesis three is supported when the Beta coefficient of "c" (the direct link) is less than the product of the Beta coefficients of "a" and "b" (the indirect link). The results of this analysis are presented forthwith

CHAPTER III

RESULTS

Validity and Reliability of Technology and Performance

Job Technology

The factor analysis performed on the technology variables (items 1 through 38) resulted in the extraction of six independent factors. These factors are labelled as follows: job routineness, job variability, job difficulty, product and production process routineness, other-dependence, and dependence on others. Table 1 depicts the items and factor loadings in the orthogonal solution for these six factors. The items listed in Table 1 are those that loaded at .4 or above on a factor. The items which defined a factor are underlined. The cumulative percent of variance explained by the six factors was 65.5 percent.

The "job routineness" factor, composed of items 1, 3, 5, 11, 12 and 18, measures the extent to which the respondent's job is routine and similar from one day to the next. The loadings are all strong, ranging from .54 to .69. High positive loadings reflect high job routineness. The "job variability" factor, composed of items 2, 9, 10 and 13, measures the degree to which there are a variety of components to the job. The loadings are all strong, ranging from

TABLE 1

FACTOR LOADINGS FOR THE SIX FACTORS OF JOB TECHNOLOGY (N=279)

Variable Number	Job Routineness	Job Variability	Job Difficulty	Product-Process Routineness	Other Dependence	Dependence on Others
V1	0.69605	0.16361	0.18046	0.21967	0.07341	-0.03716
V2	0.30367	0.56428	0.25063	0.01530	-0.01140	-0.06044
V3	0.54273	0.06362	0.14781	0.31088	0.03353	-0.02446
V5	0.65347	0.12984	0.16772	0.18967	-0.04095	-0.13639
V9	0.30715	0.75324	0.16855	0.03325	-0.03592	-0.02510
V10	0.19986	0.71023	0.04873	0.21425	0.00111	0.05334
V11	0.62651	0.27917	0.16289	0.03013	-0.06950	-0.09351
V12	0.60057	0.35990	0.11934	0.20239	0.05436	-0.14597
V13	0.04696	0.66184	0.00776	0.14223	0.11671	0.04627
V17	0.13821	0.19606	0.57640	-0.07431	-0.07223	-0.01205
V18	0.64712	0.16098	0.16014	0.26586	-0.05459	-0.06536
V19	0.14502	0.08923	0.63045	0.20670	0.08838	-0.09064
V20	0.09870	0.08429	0.73898	0.06468	-0.02104	0.14446
V23	0.19673	-0.11235	0.55026	0.09864	0.00814	-0.09505
V28	0.18048	0.32719	0.57540	0.26851	0.08069	-0.06844
V29	-0.15766	0.09374	-0.01499	-0.05337	0.09301	0.69409
V30	-0.11382	-0.08793	-0.04069	-0.03333	0.26925	0.74676
V31	0.00510	0.04895	0.00923	0.09504	0.64611	0.13616
V32	-0.01703	0.02729	0.01567	0.06643	0.94305	0.17453
V35	0.22125	0.11829	0.01491	0.66372	0.03573	-0.02885
V36	0.22942	0.16302	0.10278	0.71909	0.03846	0.08563
V37	0.44635	0.06017	0.18778	0.50515	0.03232	-0.15018
V38	0.21321	0.09999	0.20106	0.57950	0.15992	-0.12156

.56 to .75. High positive loadings reflect low job variability. The "job difficulty" factor, consisting of items 17, 19, 20, 23 and 28, measures the degree to which the components of the job are difficult, complex and predictable. The loadings are all strong, ranging from .55 to .74. High positive loadings reflect low job difficulty. The "product and production process routineness" factor, composed of items 35, 36, 37 and 38, measures the degree to which the product (or service) and the production process are standard and remain relatively the same over time. The loadings are all strong, ranging from .51 to .72. High positive loadings reflect high product/production process routineness. The "other-dependence" factor, consisting of items 31 and 32, measures the extent to which others depend on the respondent in their work. Both loadings are very strong, i.e., .65 and .94 respectively. High positive loadings reflect low other-dependence. The "dependence on others factor," composed of items 29 and 30, measures the extent to which the respondent depends on others in their work. Both loadings are very strong, i.e., .69 and .75 respectively. High positive loadings reflect low dependence on others.

The computed reliabilities, using coefficient alpha, for each of these six factors (or scales) are shown in Table 2. These reliability coefficients are all highly satisfactory, ranging from .72 to .86.

The results of this analysis demonstrate strong construct validity for the factors of job technology. The derivation of six factors from the four identified specifically in constructing the questionnaire, reflects some new facets of the dimensions of technology.

TABLE 2

RELIABILITY COEFFICIENTS FOR JOB TECHNOLOGY SCALES

Scale	Coefficient Alpha
1. Job Routineness Items 1, 3, 5, 11, 12 and 18	Alpha = .86
2. Job Variability Items 2, 9, 10 and 13	Alpha = .81
3. Job Difficulty Items 17, 19, 20, 23 and 28	Alpha = .78
4. Product/Production Process Routineness Items 35, 36, 37 and 38	Alpha = .79
5. Other-Dependence Items 31 and 32	Alpha = .79
6. Dependence on Others Items 29 and 30	Alpha = .72

First, the index of work predictability and variability might be better depicted by two separate dimensions, i.e., job routineness and job variability. Second, the index of task interdependence might be better described by two distinct dimensions, i.e., others' dependence on one's self and one's dependence on others. These new subdivisions reflect the difference between the four questionnaire indices of technology and the six factors resulting from the analysis. These six factors were utilized in the analysis associated with hypotheses two and three.

Performance

The factor analysis executed on the performance variables, (items 39 through 45), resulted in the extraction of a single factor,

labelled "perceived performance." Table 3 shows the seven items, and factor loadings from the rotated factor solution. Additionally, the reliability coefficient for this factor (or scale) is provided in Table 3.

TABLE 3

FACTOR LOADINGS AND THE RELIABILITY COEFFICIENT FOR THE PERCEIVED PERFORMANCE FACTOR (N=279)

Variable Number	Perceived[a] Performance
V39	-0.51487
V40	-0.70075
V41	-0.63770
V42	-0.76841
V43	-0.77030
V44	-0.70471
V45	-0.67722
Coefficient Alpha = .85	

[a]Note: The "negative" signs reflect lower perceived performance. Thus, later regression analysis results will reflect the direction of perceived performance as being "lower."

The perceived performance factor accounted for 55 percent of the total variance. This simple factor was the only one with an eigenvalue greater than 1.0. All seven items in the questionnaire loaded highly on this factor, with loadings ranging from -.51 to -.77. This factor (or scale) measures the perceived work-group performance. The reliability coefficient (alpha = .85) is satisfactory. High <u>negative</u> loadings reflect <u>low</u> perceived performance. This factor was utilized in the analysis associated with hypothesis three.

Delineating the Nature of the Control Process: Evaluating Hypothesis One

The test of hypothesis one was accomplished by performing a factor analysis on items 46 through 80 of the questionnaire. The factor analysis resulted in the identification of five independent factors which characterize the control process. The cumulative percent of variance explained by the five factors was 62.3 percent. These factors are labelled as follows: job autonomy, acceptance of rules and standards, compatibility among rules and standards, personal-direct control, and rule-use. Table 4 depicts the items and factor loadings in the orthogonal rotated solution for these five factors. The items listed in Table 4 are those that loaded at .4 or above for a factor. The items which defined a factor are underlined.

The "job autonomy" factor, composed of items 69, 70, 71, 73, 74, 75, and 76, measures the extent to which the respondent's job provides for discretion in how to accomplish the work. The loadings are all very strong, ranging from .62 to .86. This factor was one of the three hypothesized dimensions of control. High <u>positive</u> loadings reflect <u>high</u> job autonomy.

The "acceptance" factor is composed of items 62 through 68. This factor measures: (1) the extent to which the different standards of work performance (which prescribe such things as the quantity and quality of work to be performed) are acceptable and perceived as being realistic; and (2) the extent to which the different rules and procedures (which guide or provide direction in how to behave and perform the work) are acceptable and perceived as being realistic. The

TABLE 4

FACTOR LOADINGS FOR THE FIVE FACTORS OF CONTROL PROCESSES (N=279)

Variable Number	Job Autonomy	Acceptance of Rules & Standards	Compatibility Among Rules & Standards	Personal-Direct Control	Rule-Use
V46	-0.09243	0.00553	0.06866	0.86574	-0.16898
V47	-0.21705	0.20951	-0.00810	0.68354	-0.05136
V49	0.15596	-0.16948	-0.09688	-0.04385	0.60034
V51	0.27185	0.01768	-0.02347	-0.19313	0.62182
V55	0.16399	-0.03341	0.54107	0.25857	-0.24339
V56	0.03542	0.35986	0.59844	0.06735	-0.10456
V57	0.06450	0.12345	0.70719	-0.03548	0.03780
V58	-0.06869	0.24578	0.56763	-0.05197	0.00264
V59	0.16469	0.03777	0.60168	0.06775	-0.08262
V60	0.06548	0.31620	0.54929	-0.03384	0.09530
V62	0.20610	0.64748	0.23140	0.05543	0.01786
V63	0.08574	0.68492	0.19076	0.08044	0.06299
V64	0.13489	0.67271	0.06532	-0.03723	0.01561
V65	0.02374	0.50290	0.39569	0.07386	0.16819
V66	0.35829	0.61000	0.23302	0.04266	-0.11637
V67	0.15921	0.72610	0.03502	0.09229	-0.17128
V68	0.20045	0.74828	0.21716	0.10129	-0.14784
V69	0.85677	0.13757	0.01047	-0.04950	0.13681
V70	0.63224	0.14429	0.11164	-0.02385	0.00424
V71	0.61814	0.15093	0.05411	-0.09404	0.10376
V73	0.54134	0.21650	0.10903	-0.18714	0.33100
V74	0.77233	0.15300	0.09989	-0.04967	0.13141
V75	0.86020	0.16493	0.01128	-0.12467	0.03796
V76	0.66984	0.05477	0.06870	-0.11202	0.04095
V79	-0.12523	0.06086	0.05945	0.67877	-0.03893

loadings are all very strong, ranging from .50 to .75. High positive loadings reflect high acceptance.

The "compatibility" factor is composed of items 55 through 60. This factor measures the extent to which the various standards of work performance and/or the work rules and procedures are compatible (or not in conflict) with one another. The loadings are all strong, ranging from .54 to .71. High positive loadings reflect high compatibility.

The "personal-direct control" factor is composed of items 46, 47 and 79. This factor measures the extent to which control (and/or supervision) is performed in a direct or personal manner. The loadings are all very strong, ranging from .68 to .87. High positive loadings reflect high personal-direct control.

The "rule-use" factor is composed of items 49 and 51. This factor measures the extent to which written rules are used in the performance of work. The two loadings, .60 and .62 respectively, are strong. High positive loadings reflect low rule-use.

The computed reliabilities, using coefficient alpha, for each of these five factors (or scales) are shown in Table 5. These reliability coefficients are all highly satisfactory, ranging from .65 to .89.

As shown by the results of the factor analysis, hypothesis one as stated in this study is rejected, i.e., this study discovered five (as opposed to three) underlying dimensions of the control process. However, each of the five resulting factors appears to be clearly defined and orthogonal (or independent). These dimensions

TABLE 5

RELIABILITY COEFFICIENTS FOR CONTROL PROCESS SCALES

Scale	Coefficient Alpha
1. Job Autonomy Items 69, 70, 71, 73, 74, 75 and 76	Alpha = .89
2. Acceptance Items 62, 63, 64, 65, 66, 67 and 68	Alpha = .87
3. Compatibility Items 55, 56, 57, 58, 59 and 60	Alpha = .79
4. Personal-Direct Control Items 46, 47 and 79	Alpha = .81
5. Rule-Use Items 49 and 51	Alpha = .65

clearly depict several key components of the managerial control process. Specifically, the control process components of planning work and setting standards are reflected in the factors of rule-use, acceptance of standards and rules, and the compatibility among the various rules and standards. Additionally, the control process components of the monitoring of work and behavior and the methods of providing guidance, direction and/or corrective actions are reflected in the factors of personal-direct control and autonomy. It is interesting to note that only one of the four items associated with the Ouchi and Maguire (1975) control typology of behavior and output loaded significantly. This one item (item 79) loaded on the factor labelled "personal-direct control." This might suggest that the behavior and output modes of control are incomplete representations of the control process. These two modes appear to tap only one

component of control, i.e., the manner in which work and behavior is monitored.

In summary, the factor analysis results provided five distinct dimensions of the nature of managerial control processes. These five dimensions were utilized in the succeeding analyses associated with hypotheses two and three.

Job Technology and Control Processes: Evaluating Hypothesis Two

In examining hypothesis two, which focused on assessing the amount of variance in control processes explained by job technology, five separate multiple regression analyses were performed. Each analysis treated one of the respective five factors of control process as the dependent or criterion variable. In each analysis all six job technology factors were treated as the independent or predictor variables. Figure 3 depicts the three key "links" described in the preceding chapter, with the appropriate factors of control processes and job technology labelled based upon the factor analyses performed. The unit of analysis in this evaluation was the work-group (N=70) and work-group size was entered first into each regression equation. The results of these five regression analyses are described in the succeeding paragraphs. The R-Squared (R^2) values reported in the succeeding tables are the "adjusted R^2" values derived in the SPSS analyses.

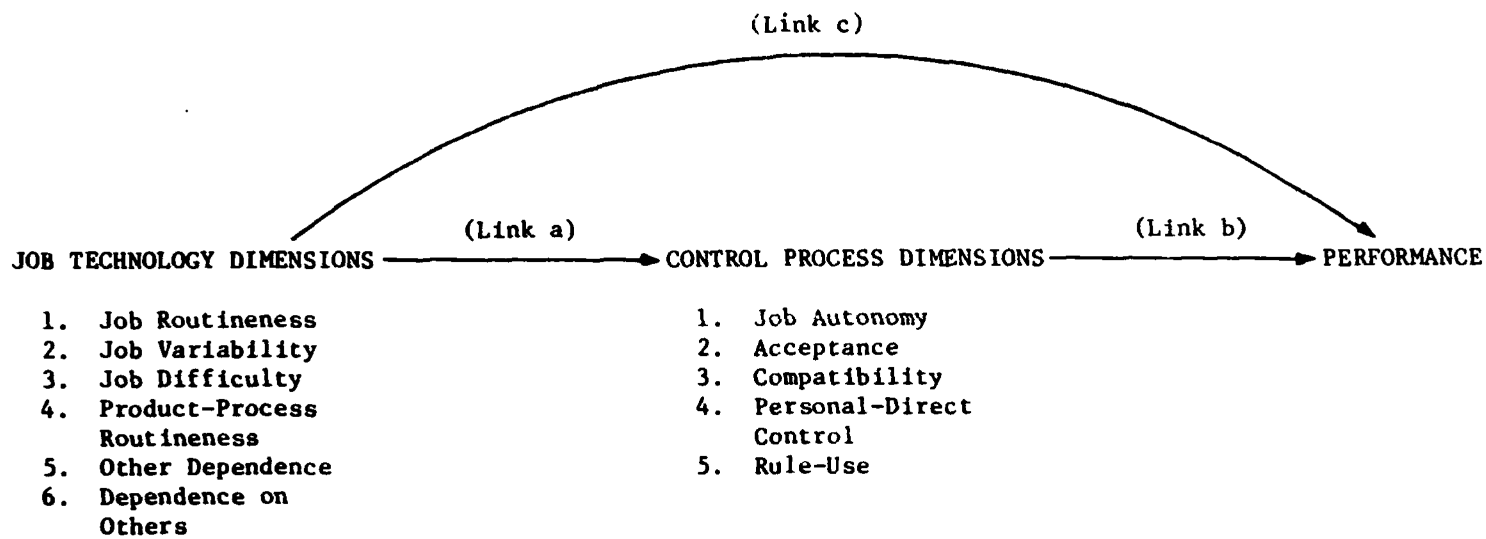

Fig. 3. Job Technology-Managerial Control Process-Performance Links

Job Technology and Job Autonomy

The results of the regression analysis, which centered on the linkage between the six job technology dimensions (or predictor variables) and job autonomy, while controlling for work-group size, are provided in Table 6.

Two predictor variables, job variability and job difficulty, had significant effects ($p < .01$ for the standardized regression or Beta coefficients) on job autonomy. Four variables, job routineness, product-process routineness, other-dependence, and dependence on others, had no significant effect on job autonomy. In addition, work-group size, the variable controlled in this study, did not have a significant effect on job autonomy.

The data provided strong indications based on the significance of the Beta coefficients, that job autonomy decreases with higher levels of job difficulty and increases with higher levels of job variability. This reinforces the desirability of assessing the unique effects of these two dimensions of job technology, both of which have been, in the past, labelled as indicators of technological or task routineness. In summary, the results of this analysis indicate that job variability and job difficulty are strong predictors of the job autonomy dimension of control processes. Based on this portion of the analysis, hypothesis two is accepted.

Job Technology and Acceptance of Rules and Standards

The regression analysis results, which focused on the relationship between the six job technology variables and acceptance

TABLE 6

JOB TECHNOLOGY PREDICTIONS OF THE JOB AUTONOMY DIMENSION OF CONTROL PROCESSES WHILE CONTROLLING FOR WORK-GROUP SIZE (N=70)

Independent Variable[a]	Dependent Variable--"Greater" Job Autonomy				
	Standardized Regression Coefficient	F	Multiple R	R^2	R^2 Change
1. Size (High)	-0.06	0.18	0.01	0.00	0.000
2. Job Routineness (High)	-0.15	1.52	0.49	0.24	0.020
3. Job Variability (Low)	-0.35	9.69**	0.32	0.10	0.103
4. Job Difficulty (Low)	0.37	9.45**	0.45	0.20	0.094
5. Product-Process Routineness (High)	-0.08	0.48	0.50	0.25	0.010
6. Other Dependence (Low)	-0.06	0.26	0.50	0.25	0.003
7. Dependence on Others (Low)	0.17	1.89	0.48	0.23	0.030

*p < .05
**p < .01

Overall R^2 = 0.25**

[a]Note: The "High" or "Low" label beside each independent variable name indicates the direction associated with positive regression coefficients and increasing "job autonomy."

of rules and standards while controlling for work-group size, are provided in Table 7.

One predictor variable, product-process routineness, had a significant effect ($p < .01$ for the standardized regression coefficient) on acceptance. The other job technology variables, i.e., job routineness, variability, difficulty, other-dependence, and dependence on others, had no significant effect on acceptance. In addition, work-group size, the variable controlled in this study, did not have a significant effect on acceptance.

Based on the significance of the Beta coefficients, the data provided strong indications that acceptance increases with higher levels of product-process routineness. In other words, to the extent that the product and the production process remain relatively the same over time, the greater will be the acceptance of the standards of work performance and the rules which provide direction in one's job. A feasible explanation is the following: to the extent that change in the product-production process is great, there will be a greater tendency to modify or change the work standards and/or the rules associated with work. Consequently, more frequent changes in rules and standards will have a more dramatic effect on the workers' perceptions of how realistic and acceptable they are. In summary, this portion of the analysis indicates that product-process routineness is a strong predictor of the acceptance dimension of control processes. Based on this portion of the analysis hypothesis two is accepted.

TABLE 7

JOB TECHNOLOGY PREDICTIONS OF THE ACCEPTANCE DIMENSION OF CONTROL PROCESSES WHILE CONTROLLING FOR WORK-GROUP SIZE (N=70)

Independent[a] Variable	Dependent Variable--"Greater" Acceptance				
	Standardized Regression Coefficient	F	Multiple R	R^2	R^2 Change
1. Size (High)	-0.02	0.03	0.10	0.01	0.011
2. Job Routineness (High)	0.07	0.28	0.45	0.20	0.004
3. Job Variability (Low)	-0.21	3.37	0.42	0.18	0.042
4. Job Difficulty (Low)	0.13	1.16	0.44	0.19	0.020
5. Product-Process Routineness (High)	0.33	7.31**	0.36	0.13	0.122
6. Other Dependence (Low)	0.00	0.00	0.45	0.20	0.000
7. Dependence on Others (Low)	0.07	0.29	0.45	0.20	0.003

*$p < .05$
**$p < .01$

Overall R^2 = 0.20*

[a]Note: The "High" or "Low" label beside each independent variable name indicates the direction associated with <u>positive</u> regression coefficients and <u>increasing</u> "acceptance."

Job Technology and Compatibility Among Rules and Standards

The results of the regression analysis, which focused on the linkage between the six job technology variables and compatibility among rules and standards while controlling for work-group size, are provided in Table 8.

One predictor variable, product-process routineness, had a significant effect ($p < .01$ for the standardized regression coefficient) on compatibility. The other five job technology variables had no significant effect on compatibility. Furthermore, work-group size did not have a significant effect on compatibility.

The data furnished strong indications, based on the significance of the Beta coefficients, that compatibility increases with higher levels of product-process routineness. This was the same predictor variable which was significant with respect to "acceptance." In other words, to the extent that the product and the production process remain relatively the same over time, the greater will be the perceived compatibility of both the standards of work performance and the rules which provide direction in one's job. A feasible explanation for this finding, similar to that provided in the preceding analysis, is the following: to the extent that change in the product-production process is great, there will be a greater tendency to modify or change the work standards and/or the rules. Consequently, more frequent changes in rules and standards will have a more dramatic effect on the workers' perceptions of how compatible they are. In summary, this analysis suggests that product-process routineness

TABLE 8

JOB TECHNOLOGY PREDICTIONS OF THE COMPATIBILITY DIMENSION OF CONTROL PROCESSES WHILE CONTROLLING FOR WORK-GROUP SIZE (N=70)

Independent Variable[a]	Dependent Variable--"Greater" Compatibility				
	Standardized Regression Coefficient	F	Multiple R	R^2	R^2 Change
1. Size (High)	0.10	0.51	0.11	0.01	0.012
2. Job Routineness (High)	-0.03	0.04	0.37	0.14	0.001
3. Job Variability (Low)	0.10	0.72	0.36	0.13	0.010
4. Job Difficulty (Low)	-0.17	0.98	0.35	0.12	0.013
5. Product-Process Routineness (High)	0.36	8.12**	0.33	0.11	0.100
6. Other Dependence (Low)	0.03	0.05	0.37	0.14	0.001
7. Dependence on Others (Low)	0.07	0.32	0.37	0.14	0.010

*$p < .05$
**$p < .01$

Overall $R^2 = 0.14$

[a]Note: The "High" or "Low" label beside each independent variable name indicates the direction associated with positive regression coefficients and increasing "compatibility."

is a predictor of the compatibility dimension of control process. However, based on this portion of the analysis hypothesis two is rejected.

Job Technology and Personal-Direct Control

The results of the regression analysis, which elucidates the relationship between the six job technology variables and personal-direct control while controlling for work-group size, are shown in Table 9.

None of the job technology variables had a significant effect on personal-direct control at a significance level of .05 or better. Two of the variables, size and others' dependence on work-group members have strong standardized regression coefficients. However, both have F-ratios which are significantly below the significance level of $p < .05$. Based on this portion of the analysis hypothesis two is rejected.

Job Technology and Rule-Use

The results of the regression analysis, highlighting the linkage between the job technology variables and rule-use while controlling for work-group size, are provided in Table 10.

Three of the predictor variables, job routineness, product-process routineness and work-group members' dependence on others, had significant effects ($p < .01$) on rule-use. The other three job technology variables had no significant effect on rule-use. In addition, work-group size did not have a significant effect on rule-use.

TABLE 9

JOB TECHNOLOGY PREDICTIONS OF THE PERSONAL-DIRECT DIMENSION OF CONTROL PROCESSES WHILE CONTROLLING FOR WORK-GROUP SIZE (N=70)

Independent Variable[a]	Dependent Variable--"Greater" Personal-Direct Control				
	Standardized Regression Coefficient	F	Multiple R	R^2	R^2 Change
1. Size (High)	0.25	3.08	0.14	0.02	0.020
2. Job Routineness (High)	0.07	0.29	0.32	0.10	0.004
3. Job Variability (Low)	-0.12	0.10	0.28	0.08	0.014
4. Job Difficulty (Low)	0.07	0.25	0.30	0.09	0.007
5. Product-Process Routineness (High)	0.07	0.30	0.31	0.10	0.003
6. Other Dependence (Low)	-0.24	3.49	0.25	0.06	0.043
7. Dependence on Others (Low)	-0.08	0.34	0.29	0.09	0.008

*$p < .05$
**$p < .01$

Overall $R^2 = .10$

[a]Note: The "High" or "Low" label beside each independent variable name indicates the direction associated with positive regression coefficients and increasing "personal-direct control."

TABLE 10

JOB TECHNOLOGY PREDICTIONS OF THE RULE-USE DIMENSION OF CONTROL PROCESSES WHILE CONTROLLING FOR WORK-GROUP SIZE (N=70)

	Dependent Variable--"Lesser" Rule-Use				
Independent[a] Variable	Standardized Regression Coefficient	F	Multiple R	R^2	R^2 Change
1. Size (High)	0.03	0.10	0.35	0.12	0.123
2. Job Routineness (High)	-0.34	13.79**	0.69	0.48	0.139
3. Job Variability (Low)	0.06	0.52	0.76	0.58	0.004
4. Job Difficulty (Low)	-0.15	2.82	0.76	0.58	0.018
5. Product-Process Routineness (High)	-0.45	26.83**	0.58	0.34	0.217
6. Other Dependence (Low)	-0.13	2.34	0.75	0.56	0.029
7. Dependence on Others (Low)	0.27	8.84**	0.73	0.53	0.053

*$p < .05$
**$p < .01$

Overall R^2 = 0.58**

[a]Note: The "High" or "Low" label beside each independent variable name indicates the direction associated with positive regression coefficients and decreasing "rule-use."

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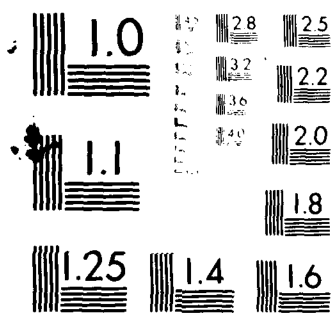

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Based upon the significance of the Beta coefficients, the data provided strong indications that rule-use increases with higher-levels of job routineness, product-process routineness and work-group members' dependence on others. These findings are congruent with earlier findings which relate task routineness and interdependence with rule-use as a dimension of formalization in organizations. In summary, this analysis indicates that job routineness, product-process routineness and dependence on others are strong predictors of the rule-use dimension of control processes. Based on this portion of the analysis hypothesis two is accepted.

Discussion of the Analysis of Hypothesis Two

The second hypothesis dealt with determining the amount of variance in managerial control processes which could be explained by job technology (previously depicted in Figure 3 as "path a"). Table 11 provides a summary of the Beta coefficients and overall equation significance for each of the five regressions performed. In light of the findings that three equations were significant, hypothesis two is accepted.

In addition to some of the major issues already highlighted in the preceding paragraphs, two points can be made after reviewing all five equations. First, one of the two nonsignificant equations, job technology and compatibility, provided a significant Beta coefficient for product-production process routineness. This job technology variable is the only one which proved to be significant in more than one of the equations; in fact it was significant ($p < .01$) in three

TABLE 11

BETA COEFFICIENTS FOR JOB TECHNOLOGY-MANAGERIAL CONTROL PROCESS LINKAGE (N=70)

Job Technology Factor[a] or Independent Variable	Managerial Control Process Factor--Dependent Variable[a]				
	Job Autonomy (High)	Acceptance (High)	Compatibility (High)	Personal-Direct Control (High)	Rule-Use (Low)
Job Routineness (High)	-0.15	0.07	-0.03	0.07	-0.34**
Job Variability (Low)	-0.35**	-0.21	0.10	-0.12	0.06
Job Difficulty (Low)	0.37**	0.13	-0.17	0.07	-0.15
Product-Process Routineness (High)	-0.08	0.33**	0.36**	0.07	-0.45**
Other-Dependence (Low)	-0.06	0.00	0.03	-0.24	-0.13
Dependence-Others (Low)	0.07	0.07	0.07	-0.08	0.27**
Overall Equation	Significant**	Significant*	Not Significant	Not Significant	Significant**

*$p < .05$
**$p < .01$

[a]Note: "High" or "Low" label for each variable indicates the direction associated with high positive values.

equations. This suggests that it is the strongest job technology predictor of control processes at the work-group level of analysis. Second, one dimension of job technology, other-dependence, was not significant in any of the five equations, which suggests that it is not a predictor of control processes at the work-group level of analysis. However, it would not be prudent to exclude this dimension of job technology from future analyses. Since this study is the first to have identified two elements of task interdependence (other-dependence and dependence on others)--and task interdependence has been found to be significant with respect to structure in previous studies--both dimensions of task interdependence should be considered in future studies.

Job Technology, Control Processes, and Performance: Evaluating Hypothesis Three

In examining the third hypothesis, which explored whether or not performance is influenced more by job technology directly than by the relationship between technology and control processes, two additional regression analyses were performed. In reference to Figure 3 (described earlier), the evaluation of hypothesis three focuses on comparing link "c" (the direct link between technology and performance) with the linkage "ab" (the indirect linkage). The Beta coefficients for link "a" were obtained for the evaluation of the second hypothesis. The two additional regressions performed in order to evaluate hypothesis three provided the Beta coefficients for links "b" and "c" respectively.

<u>Link "b"--Managerial Control and Performance</u>

The results of the regression analysis, which detailed the control process variables' predictions of performance while controlling for work-group size and job technology, are listed in Table 12.

Three of the predictor variables had significant effects on performance; the Beta coefficient for job autonomy was significant at the .05 level, while the Beta coefficients for acceptance and compatibility were even more significant at the .01 level. However, personal-direct control and rule-use had no significant effects on performance. None of the variables controlled in this equation (i.e., work-group size and all six job technology variables), had significant effects on performance.

The data provided strong indications, based on the significance of the Beta coefficients, that performance increases with higher levels of job autonomy, acceptance and compatibility. Moreover, based upon this analysis, the link between managerial control processes and performance is strong, with the exception of the two dimensions of personal-direct control and rule-use.

<u>Link "c"--Job Technology and Performance</u>

The results of the regression analysis concerned with the job technology variables' predictions of performance, while controlling for work-group size and managerial control processes, are furnished in Table 13.

TABLE 13

JOB TECHNOLOGY VARIABLES' PREDICTIONS OF PERFORMANCE[a] WHILE CONTROLLING FOR SIZE AND MANAGERIAL CONTROL PROCESSES (N=70)

Independent Variable[b]	Standardized Regression Coefficient	F	Multiple R	R^2	R^2 Change
1. Size (High)	0.08	0.50	0.06	0.00	0.004
2. Job Autonomy (High)	-0.29	6.65*	0.48	0.23	0.227
3. Acceptance (High)	-0.37	11.05**	0.59	0.34	0.114
4. Compatibility (High)	-0.34	10.96**	0.66	0.44	0.094
5. Personal-Direct Control (High)	-0.03	0.08	0.66	0.44	0.000
6. Rule-Use (Low)	0.03	0.04	0.66	0.44	0.003
7. Job Routineness (High)	0.01	0.01	0.71	0.51	0.000
8. Job Variability (Low)	0.04	0.14	0.71	0.51	0.001
9. Job Difficulty (Low)	-0.19	2.89	0.69	0.48	0.035
10. Product-Process Routineness (High)	0.08	0.30	0.71	0.51	0.003
11. Other-Dependence (Low)	-0.13	1.61	0.71	0.50	0.023
12. Dependence on Others (Low)	-0.09	0.69	0.71	0.50	0.006

*p < .05
**p < .01

Overall R^2 = 0.51**

Notes:

[a]Increasing values reflect decreasing or lower performance.

[b]"High" or "Low" label for each variable indicates the direction associated with high positive values.

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None of the job technology variables had any significant effects on performance. However, three variables relevant to managerial control processes did have significant effects, i.e., job autonomy, acceptance and compatibility at levels of .05, .01 and .01 respectively. This data indicates that the direct link between job technology and performance (link "c") is not significant, thereby providing some support for hypothesis three. However, a more complete evaluation of hypothesis three is provided by comparing the product of the Beta coefficients for links "a" and "b" (or "ab") with the appropriate Beta coefficients for link "c".

Comparison Between the Direct and Indirect Linkages for Job Technology and Performance

Comparisons were made between the Beta coefficients obtained from the previously described regression analyses, in order to evaluate the direct and indirect linkages between job technology and performance. The direct linkage Beta coefficients refer to link "c" in Figure 3. This was delineated earlier, and specifically pertains to the regression analysis which related the six job technology variables with performance while controlling for work-group size and the managerial control process dimensions. The indirect linkage includes two links, "a" and "b" in Figure 3, which refer to: (1) the relationship between the job technology variables and each of the managerial control process dimensions while controlling for work-group size, and (2) the relationship between the five mangerial control process

dimensions and performance while controlling for work-group size and job technology.

The comparisons between the direct and indirect linkages are provided in Tables 14 through 18. Each table displays the Beta coefficients for the direct linkage in comparison with the individual "a" and "b" link Beta coefficients (and their product) for one of the five respective managerial control process dimensions. In each table the "underlined" linkage reflects the more explanatory linkage, determined by comparing the product of the "a" and "b" links' Beta coefficients with the "c" link Beta coefficient. The succeeding discussions describe each of the five sets of comparisons referenced in Tables 14 through 18.

The data shown in Table 14 affords a comparison between the linkages, with job autonomy as the control process variable. The data indicate that two of the six job technology variables, job routineness and job variability, explain more variance in performance through their relationship with job autonomy. However, the other four job technology variables do not support the strength of the indirect linkage over the direct linkage. Therefore, with respect to the job autonomy dimension of control processes, the third hypothesis is rejected.

With respect to the two stronger indirect linkages, the coefficients for the links indicate the following: (1) low levels of job routineness are associated with greater job autonomy which, in turn, is associated with greater performance; and (2) high levels of job variability are associated with higher job autonomy which, in

TABLE 14

COMPARISONS BETWEEN THE BETA COEFFICIENTS OF THE "DIRECT" AND "INDIRECT" LINKAGES FOR THE JOB TECHNOLOGY-JOB AUTONOMY-PERFORMANCE RELATIONSHIP

Indirect Linkage				Direct Linkage	
	Beta Coefficients		Product of axb		Beta Coefficient
Variables Linked	(Link a)	(Link b)	(Link a-b)	Variables Linked	(Link c)
1. Job Routine-ness → Job Autonomy → Perform-ance	-0.151	-0.293*	0.044	Job Routine-ness → Perform-ance	0.008
2. Job Vari-ability → Job Autonomy → Perform-ance	-0.350**	-0.293*	0.103	Job Vari-ability → Perform-ance	0.039
3. Job Diffi-culty → Job Autonomy → Perform-ance	0.365**	-0.293*	-0.107	Job Diffi-culty → Perform-ance	-0.190
4. Product-Process Routine-ness → Job Autonomy → Perform-ance	-0.080	-0.293*	0.023	Product-Process Routine-ness → Perform-ance	0.076
5. Other-Depen-dence → Job Autonomy → Perform-ance	-0.060	-0.293*	0.018	Other-Depen-dence → Perform-ance	-0.133
6. Depen-dence on Others → Job Autonomy → Perform-ance	0.166	-0.293*	-0.049	Depen-dence on Others → Perform-ance	-0.094

*p < .05
**p < .01

turn, is associated with higher performance. With respect to the stronger direct linkages, the coefficients indicate that higher performance is associated with lower levels of job difficulty, product-process routineness, other-dependence and dependence on others.

The data shown in Table 15 supplies the linkage comparisons with acceptance as the control process variable. The data indicate that three of the six job technology variables explain more variance in performance through their relationship with acceptance. These three are job routineness, job variability and product-process routineness. The other three job technology variables do not support the strength of the indirect linkage over the direct linkage. Therefore, in terms of the acceptance dimension of control processes, the third hypothesis is rejected.

In reference to the coefficients of the three stronger indirect linkages, the following associations are evidenced: high levels of job routineness, job variability and product-process routineness are each associated with greater acceptance which, in turn, is related to greater performance. With respect to the stronger direct linkages, the coefficients attest to higher performance as associated with lower levels of job difficulty, other dependence and dependence on others.

The data displayed in Table 16 stipulate the linkage comparisons with compatibility as the control process variable. The data denote that two of the job technology variables, job routineness and product-process routineness, explain more variance in performance through their relationship with compatibility. However, the other four job technology variables do not support the strength of the

TABLE 15

COMPARISONS BETWEEN THE BETA COEFFICIENTS OF THE "DIRECT" AND INDIRECT" LINKAGES FOR THE JOB TECHNOLOGY-ACCEPTANCE-PERFORMANCE RELATIONSHIP

Indirect Linkage				Direct Linkage	
	Beta Coefficients		Product of axb		Beta Coefficient
Variables Linked	(Link a)	(Link b)	(Link a-b)	Variables Linked	(Link c)
1. Job Routineness → Acceptance → Performance	0.067	-0.372**	-0.025	Job Routineness → Performance	0.008
2. Job Variability → Acceptance → Performance	-0.213	-0.372**	0.079	Job Variability → Performance	0.039
3. Job Difficulty → Acceptance → Performance	0.132	-0.372**	-0.049	Job Difficulty → Performance	-0.190
4. Product-Process Routineness → Acceptance → Performance	0.325**	-0.372**	-0.121	Product-Process Routineness → Performance	0.076
5. Other-Dependence → Acceptance → Performance	0.002	-0.372**	-0.007	Other-Dependence → Performance	-0.133
6. Dependence on Others → Acceptance → Performance	0.067	-0.372**	-0.025	Dependence on Others → Performance	-0.094

*p < .05
**p < .01

TABLE 16

COMPARISONS BETWEEN THE BETA COEFFICIENTS OF THE "DIRECT" AND "INDIRECT" LINKAGES FOR THE JOB TECHNOLOGY-COMPATIBILITY-PERFORMANCE RELATIONSHIP

Indirect Linkage				Direct Linkage	
	Beta Coefficients		Product of axb		Beta Coefficient
Variables Linked	(Link a)	(Link b)	(Link a-b)	Variables Linked	(Link c)
1. Job Routineness → Compatibility → Performance	-0.027	-0.344*	0.009	Job Routineness → Performance	0.008
2. Job Variability → Compatibility → Performance	0.102	-0.344*	-0.035	Job Variability → Performance	0.039
3. Job Difficulty → Compatibility → Performance	-0.127	-0.344**	0.044	Job Difficulty → Performance	-0.190
4. Product-process Routineness → Compatibility → Performance	0.356**	-0.344**	-0.123	Product-Process Routineness → Performance	0.076
5. Other-Dependence → Compatibility → Performance	0.027	-0.344**	-0.009	Other-Dependence → Performance	-0.133
6. Dependence on Others → Compatibility → Performance	0.074	-0.344**	-0.026	Dependence on Others → Performance	-0.094

*$p < .05$
**$p < .01$

indirect linkage over the direct linkage. Therefore, with respect to the compatibility dimension of control processes, hypothesis three is rejected.

The following associations are mandated by the coefficients of the two stronger indirect linkages: low levels of job routineness and high levels of product-process routineness are both associated with greater compatibility which, in turn, is related with higher performance. The coefficients for the four stronger direct linkages indicate that higher performance is associated with increasing levels of job variability and decreasing levels of job difficulty, other dependence and dependence on others.

Table 17 provides the linkage comparisons with personal-direct control as the managerial control process variable. The data indicate that for all six job technology variables, the indirect linkage is not stronger than the direct path. It should be noted that none of the Beta coefficients in the indirect path were statistically significant. In other words, personal-direct control was not found to be a significant predictor of performance, nor were any of the job technology variables found to be significant predictors of personal-direct control. Therefore, with respect to the personal-direct control dimension, hypothesis three is rejected.

The data provided in Table 18 displays the linkage comparisons with rule-use as the control process variable. The data suggest that one of the job technology variables, job routineness, explains more variance in performance through its relationship with rule-use. However, the other five job technology variables do not support the

TABLE 17

COMPARISONS BETWEEN THE BETA COEFFICIENTS OF THE "DIRECT" AND "INDIRECT" LINKAGES FOR THE JOB TECHNOLOGY-PERSONAL DIRECT CONTROL-PERFORMANCE RELATIONSHIP

Indirect Linkage: Variables Linked	Beta Coefficients (Link a)	Beta Coefficients (Link b)	Product of axb (Link a-b)	Direct Linkage: Variables Linked	Beta Coefficient (Link c)
1. Job Routine-ness → Personal-Direct Control → Perform-ance	0.072	-0.029	-0.002	Job Routine-ness → Perform ance	0.008
2. Job Vari-ability → Personal-Direct Control → Perform-ance	-0.123	-0.029	0.004	Job Vari-ability → Perform-ance	0.039
3. Job Diffi-culty → Personal-Direct Control → Perform-ance	0.065	-0.029	-0.002	Job Diffi-culty → Perform-ance	-0.190
4. Product-Process Routine-ness → Personal-Direct Control → Perform-ance	0.070	-0.029	-0.002	Product-Process Routine-ness → Perform-ance	0.076
5. Other-Depen-dence → Personal-Direct Control → Perform-ance	-0.238	-0.029	0.007	Other-Depen-dence → Perform-ance	-0.133
6. Depen-dence on Others → Personal-Direct Control → Perform-ance	-0.077	-0.029	0.002	Depen-dence on Others → Perform-ance	-0.094

TABLE 18

COMPARISONS BETWEEN THE BETA COEFFICIENTS OF THE "DIRECT" AND "INDIRECT" LINKAGES FOR THE JOB TECHNOLOGY-RULE USE-PERFORMANCE RELATIONSHIP

Indirect Linkage: Variables Linked	Beta Coefficients (Link a)	Beta Coefficients (Link b)	Product of axb (Link a-b)	Direct Linkage: Variables Linked	Beta Coefficient (Link c)
1. Job Routineness → Rule-Use → Performance	-0.339**	0.031	-0.011	Job Routineness → Performance	0.008
2. Job Variability → Rule-Use → Performance	0.068	0.031	0.002	Job Variability → Performance	0.039
3. Job Difficulty → Rule-Use → Performance	-0.149	0.031	-0.005	Job Difficulty → Performance	-0.190
4. Product-Process Routineness → Rule-Use → Performance	-0.452**	0.031	-0.014	Product-Process Routineness → Performance	0.076
5. Other-Dependence → Rule-Use → Performance	-0.133	0.031	-0.004	Other-Dependence → Performance	-0.133
6. Dependence on Others → Rule-Use → Performance	0.270**	0.031	0.008	Dependence on Others → Performance	-0.094

*p < .05
**p < .01

strength of the indirect linkage over the direct path. Therefore, with respect to the rule-use dimension of control processes, the third hypothesis is rejected.

The coefficients for the single strong indirect linkage indicate that higher levels of job routineness are associated with greater rule-use which, in turn, is related with increasing levels of performance. The coefficients for the stronger direct linkages signify that higher performance is associated with increasing levels of job variability and decreasing levels of job difficulty, product-process routineness, other dependence and dependence on others.

Discussion of the Analysis of Hypothesis Three

The third hypothesis centered on determining to what extent the indirect link between job technology (through managerial control) and performance is stronger than the direct link. The regression analysis data pertaining to the links between (1) job technology and managerial control, and (2) managerial control and performance, intimated that these relationships were moderately significant. Moreover, the data pertaining to the direct relationship between job technology and performance suggested very weak relationships. However, when comparing all the Beta coefficients of the indirect and direct linkages, there is inadequate support for hypothesis three.

At the minimum, the data suggest that for several dimensions of job technology and managerial control, the indirect linkage is stronger and should be given further attention. Specifically, when we look at only those combinations of indirect links (i.e., "a" and "b")

where both Beta coefficients were statistically significant, the indirect linkage is stronger. Table 19 identifies the four specific combinations for which both coefficients were significant. This comparison indicates that three of these four indirect linkages are stronger than the direct path. However, based on the overall analysis, hypothesis three, as stated, is rejected.

Summary

In this chapter, the results of the evaluations for each of the three hypotheses of this study were reviewed. In addition, the validation of the job technology and performance constructs was described, and the respective reliabilities were provided for these constructs. With respect to job technology, six independent dimensions were identified by the factor analysis. The performance construct identified was composed of individuals' perceptions of their respective work-group performance.

The evaluation of the first hypothesis identified five independent dimensions underlying the nature of managerial control processes. These dimensions for control processes were then used, (along with the six dimensions of job technology and the performance construct), in the evaluation of hypotheses two and three.

The analysis of hypothesis two provided moderate support for the relationship between job technology and managerial control processes. Job technology explained a significant amount of the overall variance with respect to three of the five control process dimensions.

TABLE 19

COMPARISONS BETWEEN THE "DIRECT" AND "INDIRECT" LINKAGES FOR THE FOUR SETS OF RELATIONSHIPS WITH BOTH BETAs STATISTICALLY SIGNIFICANT

Indirect Linkage				Direct Linkage	
Variables Linked	Beta Coefficients (Link a)	Beta Coefficients (Link b)	Product of axb (Link a-b)	Variables Linked	Beta Coefficient (Link c)
1. Job Variability → Job Autonomy → Performance	-0.350**	-0.293*	0.103	Job Variability → Performance	0.039
2. Job Difficulty → Job Autonomy → Performance	0.365**	-0.293*	-0.107	Job Difficulty → Performance	-0.190
3. Product-Process Routineness → Acceptance → Performance	0.325**	-0.372**	-0.121	Product-Process Routineness → Performance	0.076
4. Product-Process Routineness → Compatibility → Performance	0.356**	-0.344**	-0.123	Product-Process Routineness → Performance	0.076

*p < .05
**p < .01

These three were job autonomy, acceptance of rules and standards, and rule-use.

The evaluation of the third hypothesis revealed mixed results. Specifically, when looking across all combinations of the relationships between job technology, managerial control and performance, there are several relationships wherein the amount of variance in performance explained by job technology was best rendered by the indirect link through managerial control. However, the hypothesis, as stated, cannot be supported without a greater preponderance of such evidence.

CHAPTER IV

DISCUSSION

The focus of this study has been to explore how, and to what degree, job technology affects the performance of people in organizations. As pointed out earlier, among organization theorists who espouse the contingency approach to researching behavior in organizations, considerable controversy exists in respect to the relationships between organizational technology, structure and performance. In this regard, some of the more recent literature has suggested that the technology-performance relationship might still be inappropriately conceptualized, and that the focus should be placed on a technology-control connection. Moreover, the literature propounds that the key technology-organization connection may be one resulting from certain "cognitive burdens" imposed by the tasks performed in organizations on the processes of control. These cognitive aspects are reflected by such elements as task (or job) variability, routineness, difficulty and interdependence.

In this vein, the present study sought to examine the technology-organization relationship from a different perspective, i.e., by empirically evaluating the relationships between job technology, managerial control and performance. In essence, this study

is exploratory in that it has attempted to examine some previously unexplored issues. Three specific purposes were outlined for this study. First, the researcher aspired to more clearly delineate the underlying dimensions of the nature of control processes. Second, the strength of the relationship between job technology and the dimensions of control processes was assayed. Third, the relationship between job technology, control processes and performance was investigated.

The results of this study identified five underlying dimensions (or factors) of the nature of organizational control, i.e., job autonomy, acceptance of rules and standards, compatibility among rules and standards, personal-direct control and rule-use. The study hypothesized three dimensions: the degree of personalization in exercising control, the degree of unity in exercising control, and the degree of autonomy given in exercising control. The differences between the results and the hypothesized dimensions are not extensive. Specifically, the autonomy dimension did surface as an independent factor. Also, the two factors of direct-personal control and rule-use reflect the extent of personalization in control. Furthermore, the factors of acceptance and compatibility are characteristic of the workers' perceptions of whether or not the rules and standards are consistent and united. These findings afford some clarification for Woodward's (1970) conceptualization of two dimensions to control (i.e., personal-mechanical and unitary-fragmented). Moreover, these results provide initial operational measures for evaluating control processes, an area which has not received a great deal of attention to date. This study does not suggest that the construct of managerial control is completely

delineated by the five dimensions described here. The study does, however, present an operationalization of the conceptualization described initially by Woodward (1970). Further work is undoubtedly needed in operationalizing additional elements which are closely related to control. These elements consist of work planning and the evaluation of performance. These two managerial responsibilities interact with the process of control in organizations and, therefore, should not be treated as independent constructs. Included in these two elements are the process of individual and group goal-setting, the mechanisms of assessing and providing feedback on individual and group performance, and the reward process associated with individual and group performance. Although these processes are not explicitly treated in organizational behavior literature as components of control, they are essential processes in every organization which affects or controls behavior. As such, we propose that, in the context of assessing the relationships between job technology characteristics and performance, these processes be considered as essential elements of managerial control. This approach to defining control processes is much more explicit and broader in scope than those of several key authors--namely, Woodward's (1970) two dimensional concept of control, Ouchi and Maguire's (1975) concept of behavior and output control, and Van de Ven's (1980) three modes of control. For the most part, these authors include several, but not all, of the essential elements described herein. The element of evaluation of performance is one which is not explicitly treated in any of these aforementioned conceptualizations.

In order to more fully develop an assessment of control processes, further studies should be performed utilizing the refined scales of the elements of control developed in this study, as well as operationalizing and measuring some of the additional elements described above. Since all these dimensions emphasize managerial control processes, which can vary to a great extent within organizations, it is recommended that the level of analysis for future research be at the individual and work-group levels.

The results with respect to hypothesis two suggest that characteristics of job technology are significantly associated with certain characteristics of control at the work-group level. This is in agreement with Woodward's (1970) conceptualization, although her work referred more specifically to operations technology. Also, these findings are congruent with the propositions of Slocum and Sims (1980) in relating control to uncertainty in the work and to job interdependence. A basic premise of this research is that managers can influence various characteristics of the job as well as make changes in various components of the control process. The relevance of these issues depends on the extent to which the fit between the various job technology characteristics and control process dimensions is crucial to behavior and performance. In part, the present study stressed this issue (i.e., hypothesis three). In certain respects, this issue is reflected in much of the literature pertaining to job design, which focuses on the relationships between performance, job characteristics and a variety of situational variables. Five of the job technology characteristics in this study proved to be significantly related to at

least one dimension of control. The one characteristic which did not prove to be a significant predictor was "other dependence." This dimension refers to the extent to which the work of others in one's work-group, or in another work-group, is dependent on the work of the respondent. However, the other component of task interdependence, dependence on others, did prove to be a significant predictor of the control process dimensions specified in this study. This suggests the importance of differentiating between the two components of task interdependence in future research efforts. Furthermore, the results suggest that the job technology variable labelled "product-process routineness" was the best predictor across all the dimensions of managerial control. This variable highlighted the extent of change in the process of work production and in the product (or service). Such features of change would influence the degree of uncertainty associated with the work performed, a critical dimension affecting control, and one which was articulated by various authors (e.g., Slocum and Sims, 1980). This characteristic of technology pertains directly to what has been described as "operations" technology. In this regard, it is particularly noteworthy that this dimension proved to be significant in a service-type organization. Since most of the studies focusing on operations technology have been with product-type organizations, we suggest that further research concentrate on service-type organizations.

The results from the evaluation of the third hypothesis advance several important issues. First, although the evidence did not establish a significantly stronger argument for the indirect

relationship (i.e., job technology-managerial control-performance) over the direct relationship (technology-performance), it did indicate the following: (1) that job technology by itself is not a strong predictor of performance, (2) that the managerial control process dimensions of this study are significantly associated with performance, and (3) as pointed out earlier, that job technology dimensions are significantly related to managerial control. These findings suggest that the hypothesis warrants further investigation. Specifically, new and larger samples within similar, service-type organizations should be explored. The measures of managerial control should be refined, to include the additional elements described earlier. Also, more objective, and multiple, measures of performance should be applied. In this regard, if the performance evaluation dimension of managerial control can be incorporated as an element of control (as previously advised), then performance evaluations' results might be utilized as a measure of performance. Early in this study an attempt was made to acquire such measures of performance, but this effort was unsuccessful. The availability of such measures could and should be used in conjunction with other measures, including surrogate measures of performance.

Additionally, the findings suggest the possibility that there may be some other variables moderating or confounding the relationship between technology and performance. Work-group size was controlled in this study, and should be included in future evaluations. Furthermore, in order to more adequately compare the technology/control/performance connection with the technology/structure/performance

association measures of organizational structure should be included in future investigations. In this regard, the dimensions of structure include such elements as formalization, differentiation, administrative intensity, and centralization (Ford and Slocum, 1977). The comparative evaluations of the two "connections" (i.e., structure and control) should consider possible interactive effects between structure and control dimensions, as well as unique effects of both sets of dimensions upon the technology-performance relationship.

Another variable which should be treated explicitly in future research is the environment, i.e., such environmental features as complexity, change and uncertainty. Previous research has revealed an association between environment and structure. However, environment might also directly influence job technology and managerial control. For example, the extent to which the product or service changes (product-process routineness) should be related to changes in the organization's environment. Also, the variability in tasks performed might very well be a function of uncertainty or complexity in the environment. Similarly, the degree of job discretion, or autonomy permitted, might be directly related to the complexity of the environment.

Another additional variable which should be explored in terms of possible moderating or intervening effects on the job technology/performance relationship is communications, i.e., the frequency, magnitude and patterns of communications within and between work-groups. It might be proposed that task interdependence, for example, would have a major influence on the communications between work-group

members and their supervisor. This, in turn, might have an impact on the extent to which control is personal and/or direct in nature.

In summary, a number of additional relationships require further investigation with respect to the issue of a direct or indirect connection between job technology and performance. The conclusions drawn from this study do not completely clarify either the extent or the pattern of the relationship. However, the findings do suggest that further research is warranted; they also provide an indication of some of the specific dimensions of both job technology and managerial control which merit consideration. This study centered upon one type of service organization; therefore, the conclusions do not lend themselves to indiscriminate generalizations. It would be efficacious for future research to utilize service-type organizations as well as product type firms. The present study attempted to clarify the underlying nature of managerial control processes, and to empirically explore the relationships between job technology, control and performance. The scientific method calls for a continuous interaction between theory and empirical research. Toward this end, the next stage of research must address several tasks. First, the instrument used in this study should be refined to include some of the additional dimensions of control processes as well as some of the other additional variables discussed. Furthermore, some objective measures of performance must be applied. Second, the propositions explored here should be tested in new settings, incorporating some of the additional issues (variables and possible relationships) which were identified.

Based on this effort and future work, far greater percipiency and lucidity may be achieved in regard to the taxonomy of how behavior and performance in organizations relate to job technology and to the managerial processes.

APPENDICES

APPENDIX A

MAJOR CONCEPTUAL AND EMPIRICAL WORKS ON TECHNOLOGY

INVESTIGATOR(S) YEAR PUBLISHED AND SAMPLE	THEORETICAL DEFINITION OF TECHNOLOGY	MEASURES OF TECHNOLOGY: DIMENSIONS AND OPERATIONAL DEFINITION	UNIT OF ANALYSIS (IF APPROPRIATE)
Thompson and Bates 1957 Mining, Manufacture, Hospital, University	Systems and techniques (sets of man-machine activities) which produces a good or service.	Dimensions: (1) Adaptability--extent to which the appropriate machines, knowledge, skills and raw materials can be used for other products. (2) Ratio of mechanization to professionalization--extent to which technology is lodged in human vis-à-vis non-human resources.	Organization
Woodward 1965 One Hundred British Manufacturing Firms (South Essex)	Technical Complexity Includes: Type of Production Size of Production Run Layout of Work Type of Customer Order	Dimensions Measured: Dominant method and style of the production process. Operational definition: Classified firms according to tenfold (reduced to three general) categories of scale of technical complexity of type of production process: Unit and small batch, mass production or large batch, continuous process.	Organization

INVESTIGATOR(S) YEAR PUBLISHED AND SAMPLE	THEORETICAL DEFINITION OF TECHNOLOGY	MEASURES OF TECHNOLOGY: DIMENSIONS AND OPERATIONAL DEFINITION	UNIT OF ANALYSIS (IF APPROPRIATE)
Bell 1965 Thirty Departments in one community hospital	Technical Complexity of the Work Situation or Technological Demands of the Work Situation	Dimension: Predictability of job. Classified individuals on scale based on responses to two questionnaire items measuring extent individual can consistently and accurately estimate the events that develop in relation to their work.	Individual
Bell 1967 Thirty Departments in one community hospital	Technical Complexity of the Work Situation or Technological Demands of the Work Situation	Dimension: Job Complexity of tasks performed by subordinates and supervisors. Operational: (1) degree of predictability of work. (2) amount of discretion they exercise. (3) extent of responsibility they have. (4) number of different tasks they perform.	Individual

INVESTIGATOR(S) YEAR PUBLISHED AND SAMPLE	THEORETICAL DEFINITION OF TECHNOLOGY	MEASURES OF TECHNOLOGY: DIMENSIONS AND OPERATIONAL DEFINITION	UNIT OF ANALYSIS (IF APPROPRIATE)
Perrow 1967 (Conceptual)	Technological Variability (Focus on Raw Materials). The Nature of the Raw Material only as PERCEIVED by the organization determined the extent of technological routinization.	Dimensions: Task Routineness in terms of: (1) the number of exceptions encountered in the work (degree to which stimuli are perceived as familiar or unfamiliar). (2) availability of search procedures for finding ways to deal with exceptions perceived.	Individual
Lawrence and Lorsch 1967 Ten Industrial Firms (Three Industries) Technology as a Component of Task Environment	Technological change affects certainty of task environment	Dimension: Knowledge as affected by technical rate of change. Operational: (1) clarity of information (2) information uncertainty (certainty of cause and effect relationships) (3) time span of feedback	Organization
Rushing 1968 Manufacturing Industries	Hardness of Materials to be processed	Dimension: Raw materials Operational: Ease with which material can be pierced, penetrated or broken.	Organization

INVESTIGATOR(S) YEAR PUBLISHED AND SAMPLE	THEORETICAL DEFINITION OF TECHNOLOGY	MEASURES OF TECHNOLOGY: DIMENSIONS AND OPERATIONAL DEFINITION	UNIT OF ANALYSIS (IF APPROPRIATE)
Harvey 1968 Forty-three Industrial Firms	Technology Specificity of production process (views Woodward's unit, mass, process modes of production as a move toward technical simplicity rather than complexity)	Dimension: Frequency of change (1) the number of product changes during the last ten years (2) the average of the number of different kinds of products offered during last ten years (made to order) Technically diffuse many changes "unit" / Technically specific few changes "process"	Organization
Meissner 1969 Analysis of thirty-two published case studies of work in industrial settings	Technological condition of the production process	Multiple attributes of technology: (1) elements of conversion and transfer operations included in a firm's technology (2) spatial constraints imposed (3) interdependence required among tasks	Organization

INVESTIGATOR(S) YEAR PUBLISHED AND SAMPLE	THEORETICAL DEFINITION OF TECHNOLOGY	MEASURES OF TECHNOLOGY: DIMENSIONS AND OPERATIONAL DEFINITION	UNIT OF ANALYSIS (IF APPROPRIATE)
Hage and Aiken 1969 Sixteen Health and Welfare Organizations (Private and Public)	Routineness of Work (based on Perrow's concepts)	Dimension: Extent of VARIETY in work--task variability Operational: Used five questions (four developed by Hall) to measure degree of routineness in tasks at different organizational categories.	Organization
Hickson, Pugh, and Pheysey 1969 Major study by Aston Group pertaining to Technology Forty-six Service and Manufacturing Organizations	The Production Continuity and Integration of Work Flow of Operations Technology	*Dimension:* (1) Production Continuity Operational: Modified Woodward's categorization of complexity. (2) Work Flow Integration Operational: Twenty items, comprising five subscales measuring: - degree of automation - work flow rigidity - interdependence of different segments of work flow - specificity of evaluation of operations	Organization

INVESTIGATOR(s) YEAR PUBLISHED AND SAMPLE	THEORETICAL DEFINITION OF TECHNOLOGY	MEASURES OF TECHNOLOGY: DIMENSIONS AND OPERATIONAL DEFINITION	UNIT OF ANALYSIS (IF APPROPRIATE)
Fullan 1970 1,491 manual workers from three Canadian industries (printing, automobile, oil) N=12 Plants	Production Technology The manual and machine operations performed on an object in the process of turning out a final product	Dimension: Technology type in terms of production process Operational: Classifies firms (according to Woodward's categories) by production process into: Craft, Mass Production, Continuous process	Organization
Hunt 1970 (Conceptual)	Places emphasis on a "cognitive" interpretation of technological complexity (i.e., Perrow) and on the role of uncertainty as the basic constraint upon organizational design	In conceptualizing technology and organizational design, Hunt discusses two basically distinct organizational models: 1. one oriented toward performance-mechanistic systems most management theories deal with these as if to say that organizations can rationalize their system design irrespective of any need to continue or develop searching methods, even when such movements are premature or dysfunctional. 2. one oriented toward problem solving--recognizes that it is not material technology, per se, that presents organizational challenges, rather the fact that behavioral and problem solving tasks confronting those operating the systems can be programmed and operational certainty thereby eliminated seem to be critical circumstances--, however, exceptions will still occur, uncertainty cannot be totally eliminated.	

INVESTIGATOR(S) YEAR PUBLISHED AND SAMPLE	THEORETICAL DEFINITION OF TECHNOLOGY	MEASURES OF TECHNOLOGY: DIMENSIONS AND OPERATIONAL DEFINITION	UNIT OF ANALYSIS (IF APPROPRIATE)
Morse 1970 Two Industrial firms Two Communication firms	Certainty of the Task environment (using as basis, Lawrence and Lorsch, 1967)	Operational: Measure the routineness, predictability and certainty of work with focus on raw materials and knowledge.	Organization
Zwerman 1970 Fifty-five Manufacturing firms	Technical Complexity (replication of Woodward, 1965)	Dimension: Dominant method and type of production process Operational: Classified firms into small batch, mass production and continuous process.	Organization
Magnusen 1970 Dissertation Fourteen industrial firms (salaried-exempt personnel) Exploratory	His conceptual framework is based on Perrow Technology, or the work done in organizations--"the actions that an individual performs upon an object, with or without the aid of tools or mechanical devices, in order to make some change in that object."	Two aspects or dimensions of this cognitive technology: 1. the number of exceptional cases an individual encounters in his work 2. the degree to which stimuli are perceived as familiar or unfamiliar, i.e., these are two continua, which vary independently, exceptions and search.	Organization

INVESTIGATOR(S) YEAR PUBLISHED SAMPLE	THEORETICAL DEFINITION OF TECHNOLOGY	MEASURES OF TECHNOLOGY: DIMENSIONS AND OPERATIONAL DEFINITION	UNIT OF ANALYSIS (IF APPROPRIATE)
Perrow 1970 (working paper and reported in Magnusen 1970) Fourteen manufacturing firms, foreman to president (N=2,633)	Technological uncertainty in the outcome of actions performed upon the raw materials (object, symbol or human) to be transformed.	Dimension: Task routineness in terms of 1. The number of exceptions encountered in the work--perceived nature of the raw materials. 2. The availability of search procedures--the actions of workers in response to their perception of the nature of the materials.	Individual
Mohr 1971 One hundred, forty-four work groups from thirteen local health departments	Manageability of the task and materials Focus: Operations Technology--both the raw materials and the production process	Dimension: Predictability of tasks and materials at the individual job level in terms of uniformity, complexity and analyzability. Operationally: uniformity, complexity and analyzability calculated from three quantities	Individual
Blau and Schoenherr 1971 Fifty-three state, employment security agencies throughout all fifty states, D.C., Virgin Islands and Puerto Rico	Technological Innovation Complexity (Utilization of Computers)	Focus on operations technology Operational: Automation of operations/ automation of equipment--13 category score of the scope of computer installation, based on number of computers and the number of input-output units.	Organization

INVESTIGATOR(S) YEAR PUBLISHED AND SAMPLE	THEORETICAL DEFINITION OF TECHNOLOGY	MEASURES OF TECHNOLOGY: DIMENSIONS AND OPERATIONAL DEFINITION	UNIT OF ANALYSIS (IF APPROPRIATE)
Child 1972a (Conceptual)	Technology is a product of decisions on work plans, resources, and equipment made in the light of certain evaluations of the organization's position in its environment.	Questions looking at any of the major contingency arguments that organization structure varies as a direct function of environment, size or technology--i.e., all of these fail to incorporate the direct source of variation in formal structural arrangements, the strategic decisions of those who have the power of structural initiation--the dominant coalition.	
Child 1972b	Production continuity and Integration of the Work Flow of Operations Technology	Operational: Used Aston Group's subscales for Work Flow Integration	Organization
Child and Mansfield 1972 Eighty-two business organizations Replication of Hickson et al. and a deeper exploration of measures of technology	Production continuity and Integration of the Work Flow of Operations Technology	Operational: Used Aston Group's subscales for Work Flow Integration	Organization

INVESTIGATOR(S) YEAR PUBLISHED AND SAMPLE	THEORETICAL DEFINITION OF TECHNOLOGY	MEASURES OF TECHNOLOGY: DIMENSIONS AND OPERATIONAL DEFINITION	UNIT OF ANALYSIS (IF APPROPRIATE)
Aldrich 1972 Re-examination of findings of Aston Group using Path Analysis	Same as Aston Group	Same as Aston Group	Organization
Grimes, Klein and Schull 1972	Task Variability	1. Degree of task standardization 2. Degree of role specificity (appears to be more a measure of structure)	Organization
Grimes and Klein 1973 Three separate samples, total of 828 managers in 14 plants from 1 large manufacturing organization	Task Unit Technology in terms of complexity		Unit and Organization
Child 1973 787 senior managers in 78 British business organizations	Work Flow Integration (Aston Group theory)	Work Flow Integration as measured earlier	Organization

INVESTIGATOR(S) YEAR PUBLISHED AND SAMPLE	THEORETICAL DEFINITION OF TECHNOLOGY	MEASURES OF TECHNOLOGY: DIMENSIONS AND OPERATIONAL DEFINITION	UNIT OF ANALYSIS (IF APPROPRIATE)
Freeman 1973 Forty-one Manufacturing Organizations	Mechanization of production systems (technical complexity)	Substance produced (integral or dimensional) Extent of automation applied	Organization
Khandwalla 1974 Seventy-nine Manufacturing firms	Focus on operations technology for manufacturing--specifically the extent of mass output orientation of technology used by the organization.	1. Used expanded version of Woodward's technology descriptions in her scale of technical complexity to include 5. 2. Differentially weighted the ratings of the use of the 5 technologies to measure the mass output orientation of the firms' operations. *Least Mass* Output Oriented: Custom — Most: Continuous process	Organization
Van de Ven and Delbecq 1974 120 work units within a large government employment-security agency (1 of the 58 studied by Blau and Schoenherr)	Develop a Task-Contingent Model of Work-unit structure (modification of Grimes et al., 1972, Matrix Model). Measure what is fundamentally the degree of routineness of a work-unit's task.	Two dimensions of work units 1. Task difficulty--analyzability of work: degree of complexity of search process, thinking time required, etc. Set of perceptual measures. 2. Task variability--number of exceptional cases encountered.	Work units

INVESTIGATOR(S) YEAR PUBLISHED SAMPLE	THEORETICAL DEFINITION OF TECHNOLOGY	MEASURES OF TECHNOLOGY: DIMENSIONS AND OPERATIONAL DEFINITION	UNIT OF ANALYSIS (IF APPROPRIATE)
Lynch 1974 Fifteen departments in three large academic libraries (based upon her dissertation) N=384	Technological Variability of Tasks	Seven item (3 factor) scale Factors: 1. Predictability of events 2 items 2. Routineness of operations 2 items 3. Insufficient knowledge 3 items	Department or subunits of the organization
Hrebiniak 1974 210 supervisors and subordinates in various departments in one general hospital	Multidimensional view using a combination of measures borrowed from previous studies (Note: As in Mohr and Bell's works, there appears to be some overlap between the technology and structure variables)	Used four aspects of technology: 1. technological level of the job 2. task predictability using Bell's (1965) 2 questions to measure routineness by a task (based upon Perrow) 3. task interdependence - 1 question control using Mohr (1971) 4. task manageability - 3 questions using Mohr (1971)	Individual and Department
Mahoney and Frost 1974 297 department/divisions from seventeen business and industrial firms	Distinguishes between distinct yet linked subunit technologies in a given firm based upon nature of discretion permitted by the technology	Used Thompson's (1967) three varieties of technology--i.e., long linked mediating intensive or custom and classified subunits of firms into these categories based upon nature of discretion permitted.	Organizational Unit, i.e., sections, department, or division

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Child 1974 Attempt to determine if universalistic theory is explanatory of performance	Asks: What determines levels of performance? -- Answer -- A number of influences. Both universalistic and contingency perspectives assume that it is possible to identify certain factors which will in some degree determine levels of performance. However, performance is not simply an end-product, a dependent variable; the fact that the level of performance is found to relate to a feature of organization does not by itself tell us to what extent performance is a consequence or the cause of that feature--i.e., stimulate adjustments in policies and modes of operation. Findings: Child found no support for some universalistic arguments, thus the context in which the organization is operating may be relevant.		
Child 1975 Attempt to determine if contingency theory is explatory of performance size, environment, technology	Work flow integration	Continuity and rigidity of production system.	Organization

INVESTIGATOR(S) YEAR PUBLISHED AND SAMPLE	THEORETICAL DEFINITION OF TECHNOLOGY	MEASURES OF TECHNOLOGY: DIMENSIONS AND OPERATIONAL DEFINITION	UNIT OF ANALYSIS (IF APPROPRIATE)
Blau, Falbe, McKinley and Tracy 1976 110 manufacturing plants. Size, on the average, was smaller than Aston Group's and larger than Woodward's	1. Degree of Mechanization of the Production Technology	Used: Amber and Amber's automaticity scale and Modified Woodward Scale	Plant or manufacturing site
	2. Automation of various functions (similar to Blau and Schoenherr)	Number of different functions for which an on-site computer used. Number of functions automated by *off*-site computers. Total computer use.	
Stanfield 1976 (Review and Appraisal)	In sociotechnical studies the problem of confusing the relationship between technology and structure is due to; (1) attempt to generalize the findings by drawing conclusions about variables not measured or (2) failure to set forth the boundaries between the categories (technology and structure); i.e., assuming the categories are homogeneous. This facilitates making the assumption that the operation of one or a few variables in a category adequately represents the operations of the category as a whole. Recommends: (1) conceptual disaggregation of the overall categories, i.e., draw conclusions only in terms of the specific variables. (2) rationalize the categorization of the variables, i.e., set forth their boundaries--distinguish them, give clear theoretical definitions so as to delimit the variables measured, and provide explanations for their use.		

INVESTIGATOR(S) YEAR PUBLISHED SAMPLE	THEORETICAL DEFINITION OF TECHNOLOGY	MEASURES OF TECHNOLOGY: DIMENSIONS AND OPERATIONAL *DEFINITION*	UNIT OF ANALYSIS (IF APPROPRIATE)
Hunt 1976 Conceptual inquiry into the nature of tasks and how they can be *expected to determine or affect* organization and managerial events	Since organizations do literally exist for the doing of tasks, it is eminently reasonable for one *to expect basic effects upon the organization's processes* and outputs which can be traced *to variations* in the properties of the tasks they are performing. Good review on contemporary research interest in task phenomena--particularly pointing out how task-performance-structure linkages have been fairly well established. The specifiability and programmability of organization tasks, separately and in interaction, can be viewed as their crucial feature insofar as organizational impact is concerned. Hunt's argument is that organizational processes, if not completely determined, are importantly constrained by influences associated with the tasks on which they work. This view recognized the existence of managerial choice, however, *it claims that* the extent of managerial choice may vary; i.e., it recognizes a view of organization as an open system, faced with uncertainty and subject to "criteria of rationality." Hunt cautions us not to take a simplistic or unidirectional conception of task-organization relations. 1. He recognized that *there are two perspectives* of task constraints in organizations: (a) task effectiveness on behavior and (b) task effects on organization--Hunt focuses on the latter. 2. He argues that the individual's task determines his organizational role (in part) and thus the aggregation of individual tasks produces the organizational requirements for division of labor, which, in turn, affect the need for certain managerial task functions (such as control). Hunt conceptualizes a task as a process of modeling. (1) Tasks models represent perceptions of the what and how of a task--i.e., conceptual specifications of unit operator-level tasks. (2) Task modeling is a process of trying to specify the nature and requirements of a task and elaborating ways of doing it.		

INVESTIGATOR(S) YEAR PUBLISHED AND SAMPLE	THEORETICAL DEFINITION OF TECHNOLOGY	MEASURES OF TECHNOLOGY: DIMENSIONS AND OPERATIONAL DEFINITION	UNIT OF ANALYSIS (IF APPROPRIATE)
Hunt 1976 (con't)	Technology is related to task modeling in two ways. 1. The nature of task determines the resources necessary for performing them. 2. Perceptions of nature of task expand on "the technological perspectives brought to bear on it." In addition to this dual relationship, task models may vary over time and to some extent with the individual doing the modeling. Organizations must assure the "official" (formal) and "operator generated" (informal) models are integrated--this takes place at the work flow level (conceptualized as the expanded task model) where discrete tasks are integrated into a system "purposely oriented" to yield determinate outputs. Thus organizations need a planning and control system to provide feedback and make corrective actions with respect to deviations.		
Comstock and Scott 1977 142 patient care ward from sixteen hospitals	Extent of Task and Work flow Predictability: Technological predictability refers to extent to which raw materials and transformation processes were well understood so they presented few unexpected contingencies for qualified performers.	Task predictability--extent to which raw materials and task activities associated with the performance of a particular job were well understood and nonproblematic for individuals. Work flow predictability is the extent to which raw materials (associated with the combination of tasks carried on by organization subunits) were well understood and nonproblematic for individuals as a unit.	Focus on level of the work group or subunit, however, attempt to differentiate those variables that summarized characteristics of individual work from those that describe the work of the subunit.

INVESTIGATOR(S) YEAR PUBLISHED AND SAMPLE	THEORETICAL DEFINITION OF TECHNOLOGY	MEASURES OF TECHNOLOGY: DIMENSIONS AND OPERATIONAL DEFINITION	UNIT OF ANALYSIS (IF APPROPRIATE)
Overton, Schneck and Hazlett 1977 Seventy-one nursing subunits in eight Canadian hospitals	As a result of this study specified 3 dimensions of technology in various types of nursing subunits (a) Uncertainty (b) Instability (c) Variability	Thirty-four item questionnaire: eliminated six. Initial questionnaire built from Perrow's two dimensions and Hickson et al.'s dimensions of task interdependence. Three factors (28 items) emerged around the dimensions of uncertainty, instability and variability.	Subunits (N=71) (nursing subunits)
Gillespie and Mileti 1977 Review and Appraisal	"The types and patterns of activity, equipment and material, and knowledge or experience used to perform tasks."	Although quite broad, this definition: (a) subsumes the variety of uses to which the term technology has been put. (b) avoids reifying technology as a force independent of human choice and activity. (c) expands the meaning of technology beyond the machine or hardware conceptualization. (d) provides a foundation for the use of a single classification scheme in studying all types or organizations. (e) promotes a unified perspective of technology.	

INVESTIGATOR(S) YEAR PUBLISHED AND SAMPLE	THEORETICAL DEFINITION OF TECHNOLOGY	MEASURES OF TECHNOLOGY: DIMENSIONS AND OPERATIONAL DEFINITION	UNIT OF ANALYSIS (IF APPROPRIATE)
Jelinek 1977 Review and Appraisal (Conceptual)	Proposes a multiple-environment, multiple-technology model of the firm (of complex organizations) and suggests the notion of intervening technologies (mediating his fit between the organization and its environment). Environment varies on dimension of uncertainty; Technology varies on dimension of specificity. Environment, technology and infrastructure (various organizational structures or departments which themselves also have technologies and environments and are, in a sense, organizational buffers) interact with one another and with organizational structure. We expect the intervening technologies (of the infrastructure) to fall between the core technology and the environment in their tolerance for uncertainty--buffering. Implicit in Jelinek's conceptualization of the "fit" between multiple environments, engendered by multiple technologies, is the activity of buffering. As described, "buffering" as an activity seems to refer to control and possibly coordination. Thus the core technology and its delineation of primary task environment and characteristics impose an initial configuration, relating this technology to an uncertain external environment. The core is buffered by the articulation of input-output, regulation, and maintenance functions (functions of controlling). However, all these functions are dependent upon their own technologies and environments, as well as upon the "control conversion process."		
Ford and Slocum 1977 Review and Appraisal	1. Although they classify formalization and centralization as major elements of structure, they specifically label these two as "control strategies." 2. In spite of differences conceptually (i.e., whether technology is unidimensional or multidimensional) and operationally (at what levels to measure), task predictability (routineness or programmability) seems to be a common dimension underlying the various approaches and measures. Woodward saw her scale as encompassing the degree of control or predictability (also, Harvey, Hall, Hage and Aiken, Van de Ven et al.) who considered routineness in their measures. Also Hickson et al.'s work flow integration measure implicity assumes predictability, a requisite condition for automation.		

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Dewar and Hage 1978 Sixteen social service organizations	Task scope (complexity routineness and change) -variety of inputs or tasks that need to be accomplished, task variability, and ratio of change in tasks.	Combined responses to executive director to two questions--the two scores equalled organization score for task scope. 1. What is degree of involvement with clients? Do they come in for scheduled treatment visits? Do they come in for day-long or half-day visits? Are they receiving round-the-clock services? 2. How many different types of client disabilities does your organization deal with?	Organization
Glisson 1978 Thirty Human service organizations	Technology routinization = the uniformity of client problems as assessed by the line worker and the uniformity of the problem-solving procedure.	Modified Lynch's (1974) scale and added some new items. Total of 6 items.	Organization

INVESTIGATOR(S) YEAR PUBLISHED AND SAMPLE	THEORETICAL DEFINITION OF TECHNOLOGY	MEASURES OF TECHNOLOGY: DIMENSIONS AND OPERATIONAL DEFINITION	UNIT OF ANALYSIS (IF APPROPRIATE)
Rousseau 1978a Nineteen production units from thirteen organizations, total of 201 employees completing questionnaires	Technology--the process of transforming informational and material inputs into outputs. Composed of: 1. Technology classification of Thompson--amount of discretion. 2. Perceived job characteristics by individuals. 3. Aggregated department level perceived job characteristics.	1. Two independent observers classified each of nineteen units into one of the three Thompson categories. 2. Job Diagnostic Survey measured perceived job characteristics by individuals. 3. The individual responses to perceived job characteristics (measured by JDS) were averaged within each department to create a measure of the unit's technology based on perceptions.	Individuals and Subunit (department)
Rousseau 1978b Nineteen distinct departments in two distinct firms (one electronics, one radio station)	Technology = process of transforming inputs into output. Degree of mechanization and How much discretion (decision making) is required of the human operator.	Degree of merchanization measured (as does Aston Group) by classifying the equipment used in each department into categories ranging from hand tools to computers. Degree of discretion in work process measured by placing each department into one of Thompson's three technical categories based upon observations of the work process and discussions with management.	Organization (Department of organization)

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Montanari 1978 Review and Appraisal	Proposes an alternative model (vis-à-vis the size, or technology or environment linkage with structure and linkage with organization effectiveness) which incorporates managerial discretion. Montanari's model: Contextual factors (size, technology, environment) provide information with inputs to the managers describing internal and external conditions and thereby defining or constraining the range of managerial discretion with respect to strategic decisions. Organizational objectives and prior performance (fed back to the manager) also influence strategic decisions. Strategic decisions are the result of selections from these discretionary ranges, based on the manager's discretion. Managerial discretion is measured as the decision maker's predisposition to solve organization problems by implementing structural modification. The behaviors of several groups comprising the organization's constituency are influenced by these decisions. Behavior consistent with organization objectives results in effective performance.		
Tushman 1979 Organized projects (N=44) within the Research and Development Laboratory of one large American corporation	Focus here is on: Subunit's information processing requirements as a characteristic of work. Work-related uncertainty has three sources: 1. Task characteristics 2. Task environment 3. Task interdependency	1. Task characteristics nonroutine to routine continuum (research to technical service) 2. Task environment (changing to stable continuum) 3. Task interdependence degree to which the task of the project requires working with other units of the organization.	Subunits (Projects within seven departments of one Research and Development Laboratory of a large American corporation).

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Dewar and Werbel 1979 Fifty-two departments of thirteen consumer reporting organizations	Perceived routineness of technology (adopted Perrow's 1970 definition because it deals with the perceived characteristics of tasks rather than the arrangements or types of machines).	The degree of routineness of technology increases as work is perceived to have fewer exceptions and as these exceptions are better understood. Four items measuring: The variability dimensions (extent of exceptions) and the analyzability dimension.	Departments
Gerwin 1979 (Review and Appraisal)	Four problem areas in the comparative analysis of structure and technology. 1. Emphasis has been on trying to find patterns of relationships existing among these variables. Little attention is being given to designing new, more appropriate patterns, i.e., toward explaining or discovering the underlying causal networks of variables. 2. Emphasis has been to understand the social entity, whole organization without reference to their components, subunits. - An organizational level focus is too aggregative. - When focusing on components, we should look at interdependence and diversity between components. 3. Cannot assume technology and structure are independent constraints. 4. Need more attention in design (versus explanatory orientation)--e.g., need more focus on managerial discretion.		

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Mealiea and Lee 1979 (Review and Appraisal)	Argues that we have failed to integrate both the macro (size, technology, environment linkage with structure) and micro (structure linkage with employee behavior) dimensions. This seems to be congruent with similar proposals made by Ford and Slocum, Dewar and Werbel, Gerwin) Integration model: 1. Assumes the organization is an open system whose activity interacts with its environmental suprasystem through permeable boundaries. 2. Organization is envisioned as a system composed of interrelated constituent subsystems which both support and are supported by the total organization. 3. The organization's primary goal is survival within its environment. The model suggests: Congruence must exist between three levels (a) environment, size, technology level (b) structural level (c) work-unit employee level		
Bobbitt and Ford 1980 (Conceptual)	Suggest an expansion of the structure-contingency framework to include the analysis of the decision maker(s) choice in explaining and predicting organization structure. Propose that structure is the result of an interaction between the decision maker (his cognitive, motivational orientations and transformation strategies) and the organization's context. Call to question the validity of the deterministic type of frameworks.		

INVESTIGATOR(S) YEAR PUBLISHED AND SAMPLE	THEORETICAL DEFINITION OF TECHNOLOGY	MEASURES OF TECHNOLOGY: DIMENSIONS AND OPERATIONAL DEFINITION	UNIT OF ANALYSIS (IF APPROPRIATE)
Hunt and Near 1980 (Working Paper)	Technology: "knowing how to do things with things" 1. Remains unclear whether or not the organization-technology relationship has so far been appropriately conceived. 2. Review of literature depicts a need for a strict conceptual separation of technology and job attributes (e.g., discretional). 3. Dynamic views: (Meissner, Comstock and Scott, Hunt, Gerwin, Dewar and Hage) encourage focus on the process by which the relationship between technology and structure is established and maintained. 4. They also point out that the relationship is stronger at the subunit (vs. organization) level. 5. Researchers today have indicated some acceptance of a more moderate view of technology's constraining effects on structure and on other organization features (vis-à-vis a precise one-to-one determinative association of particular technologies and structures). 6. This "softened" hypothesis does not posit specific determinative relations between technology and structure; rather, technology imposes certain limits on organization choices and actions. Furthermore, other variables (e.g., size, certain environmental constraints) may constrain the organizations with respect to structure. Finally, the organization must adapt to changing constraints and uncertainties in order to enhance performance. 7. A more productive alternative would seem to be acknowledgment by organization theorists of a technological connection to organization structures and processes and more diligent exploration of just <u>how</u> technology affects <u>which</u> structures and processes, to what degree, and under what conditions.		

INVESTIGATOR(S) YEAR PUBLISHED AND SAMPLE	THEORETICAL DEFINITION OF TECHNOLOGY	MEASURES OF TECHNOLOGY: DIMENSIONS AND OPERATIONAL DEFINITION	UNIT OF ANALYSIS (IF APPROPRIATE)
Dewar, Whetten, Boje 1980	Examine the reliability and validity of the Aiken and Hage scales of task routineness, Centralization and Formalization. 1. Good review of pointing out the different conceptualizations of these constructs. 2. With respect to Technology (a) Hage and Aiken concentrated on <u>perceived</u> routineness scale (<u>dealing</u> with the variety of work dimension only). (b) Hage and Aiken do not include Perrow's <u>dimension</u> of <u>analyzability of search</u> procedures. *Although Perrow (1970) argues that* while his two dimensions are conceptually distinct they would be expected to be empirically related.		

APPENDIX B

QUESTIONNAIRE ASSESSING THE NATURE OF ORGANIZATIONAL TECHNOLOGY, CONTROL PROCESSES, AND PERFORMANCE

PRIVACY STATEMENT

In accordance with paragraph 30, AFR 12-35, the following information is provided as required by the Privacy Act of 1974:

a. Authority:

(1) 5 U.S.C. 301, Departmental Regulations; and

(2) 10 U.S.C. 8012, Secretary of the Air Force, Powers, Duties, Delegation by Compensation; and

(3) EO 9397, 22 Nov 43, Numbering System for Federal Accounts Relating to Individual Persons; and

(4) DOD Instruction 1100.13, 17 Apr 68, Surveys of Department of Defense Personnel; and

(5) AFR 30-23, 22 Sep 76, Air Force Personnel Survey Program.

b. Principal purposes. The survey is being conducted to collect information to be used in research aimed at illuminating and providing inputs to the solution of problems of interest to the Air Force and DOD.

c. Routine uses. The survey data will be converted to information for use in research of management related problems. Results of the research, based on the data provided, will be included in a written doctoral dissertation and may also be included in published articles, reports, or texts. Distribution of the results of the research, based on the survey data, whether in written form or presented orally, will be unlimited.

d. Participation in this survey is entirely voluntarily.

e. No adverse action of any kind may be taken against any individual who elects not to participate in any or all of this survey.

GENERAL INFORMATION

The purpose of this questionnaire is to obtain information about you, your job, your work group and your organization. Specifically, this information is being collected in support of research assessing the relationships between the nature of job technology, job control processes and performance in organizations.

Please be assured that all information will be held in the strictest confidence. Your individual responses will NOT be provided to your organization or to any other agency. Only the individual performing this research will have access to your completed questionnaire. In addition, when the results of this study are published, readers will NOT be able to identify specific individuals or work groups.

When you have completed the questionnaire, please seal it and the two machine-scored response sheets in the enclosed, addressed envelope and return it through inter-office mail distribution within five working days.

Thank you for your cooperation. If you have any questions please contact the researcher at the following address:

Major Nestor K. Ovalle, 2d
AFIT/LSB
Wright-Patterson AFB OH 45433
Office Phone: 255-4529

KEY WORDS

The following should be considered as key words throughout the questionnaire:

1. Supervisor: The person to whom you report directly.
2. Work-Group: All persons who report to the same supervisor as you do.
3. Organization: The overall organizational unit (e.g., Base Hospital, Organizational Maintenance Squadron, etc.). The overall organizational unit will be composed of various (perhaps many) work groups which might be referred to as sections, branches or departments.

INSTRUCTIONS

1. This questionnaire is composed of 5 sections, with a total of 100 items (individual "questions") numbered "1" through "100". All 100 items must be answered by filling in the appropriate spaces on

the machine-scored response sheets provided. If for any item you do not find a response that fits your case exactly, use the one that is the closest to the way you feel.

2. Please use a "soft-lead" (number 2) pencil, and observe the following:

a. Make heavy black marks that fill in the space (of the response you select).

b. Erase cleanly any responses you wish to change.

c. Make no stray markings of any kind on the response sheet.

d. Do not staple, fold or tear the response sheet.

e. Do not make any markings on the questionnaire booklet.

3. You have been provided with two response sheets. Do NOT fill in your name on either sheet so that your responses will be anonymous. Please note that each sheet has an ID number (in the spaces labelled "Identification Number") ending with the number "1" or "2". Please use the response sheet with the ID number ending with the number "1" to respond to the first 80 items (or questions) and then answer questions 81 through 100 on the response sheet with the ID number which ends with the number "2', using the first 20 answer blocks.

4. Each response block has 10 spaces (numbered 1 through 10) or a 1-10 scale. The questionnaire items normally require a response from 1-7 only, therefore, you will rarely need to fill in a space numbered 8, 9, or 10. Questionnaire items are responded to by marking the appropriate space on the response sheet as in the following example:

Using the scale (seven descriptive statements which may reflect your opinion) below, evaluate "sample item 1."

SCALE

1 = Strongly disagree
2 = Moderately disagree
3 = Slightly disagree
4 = Neither agree nor disagree
5 = Slightly agree
6 = Moderately agree
7 = Strongly agree

Sample item 1:

The guidance you receive in your job from your supervisor is frequently unclear.

[If you "moderately agree" with sample item #1, you would "blacken in" the corresponding number of that statement (moderately agree = 6) on the response sheet for item numbered "sample item 1".]

Sample response: 1 2 3 4 5 6 7 8 9 10

THE NATURE OF THE JOB TECHNOLOGY

Instructions

Below are 38 items (numbered 1 through 38) which relate to the nature of the tasks and work performed by you. Read each item carefully and then decide to what extent you agree with each item. Indicate the extent of your agreement by choosing the statement below which best represents your opinion and "blacken in" the corresponding number of that statement on the separate response sheet for items numbered 1 through 38.

1 = Strongly disagree
2 = Moderately disagree
3 = Slightly disagree
4 = Neither agree nor disagree
5 = Slightly agree
6 = Moderately agree
7 = Strongly agree

1. I do about the same job in the same way most of the time.

2. There is a great deal of variety in the work I do.

3. Regardless of the variety of work I do, the methods I use to do it are about the same.

4. Think of the different work inputs which generate work for you (e.g., requests or requirements made by a supervisor, another office worker, another work group, another organization). In my job I am able to anticipate and predict the frequency of these work inputs most of the time.

5. In my job I encounter the same kinds of problems most of the time.

6. Many jobs require the use of searching procedures (to search for information essential to accomplishing the work). The searching procedures I use in my job are very similar from one day to the next.

7. The decisions I make in my job are very dissimilar from one day to the next.

8. It is very difficult to learn enough about my job to handle all of the different problems that come up.

9. I encounter a great deal of variety in the types or kinds of tasks in my job.

10. I encounter a great deal of variety in the types of methods I use to perform my work.

1 = Strongly disagree
2 = Moderately disagree
3 = Slightly disagree
4 = Neither agree nor disagree
5 = Slightly agree
6 = Moderately agree
7 = Strongly agree

11. In my job I basically perform repetitive activities from one day to the next.

12. Regardless of the variety of work I do, my job is mainly concerned with routine matters.

13. In my job there is a great deal of variety in the events that cause or generate my work.

14. In my job there is a great deal of uncertainty about the appropriateness of a given procedure (method) to use in accomplishing a given task.

15. In my job it is very difficult to predict the work/tasks I'll be performing from one day to the next.

16. There is a clear and understandable sequence of steps that I follow in doing most of my work.

17. In the course of my job I frequently encounter difficult problems which I don't know how to solve immediately.

18. The majority of the problems I encounter in my job are similar from one day to the next.

19. The problems I encounter in my job are of such a nature that they require a great deal more time devoted to "thinking" (e.g., trying to define them specifically, deciding what further information is needed to identify causes and/or potential alternative solutions, etc.) than to actually acting on some solution(s).

20. The problems I encounter in my job are of such complexity that they require a great deal of consultation with others (in or outside of your work group) and/or they require a great deal of reference to written guidelines/procedures before I can act on some solution(s).

21. If, in my job, I encounter some problem that I don't know how to handle, there are others I can readily consult with who will know how to resolve it.

1 = Strongly disagree	5 = Slightly agree
2 = Moderately disagree	6 = Moderately agree
3 = Slightly disagree	7 = Strongly agree
4 = Neither agree nor disagree	

22. If, in my job, I encounter some problem that I don't know how to handle, there is documentation (written guidelines, procedures, etc.) I can readily consult to show me how to resolve it.

23. In some jobs things are fairly predictable. In others, you are often not sure what the outcome will be. In my job I am sure what the results of my efforts will be most of the time.

24. Aside from formal training (i.e., the basic prerequisite training required of all job applicants for my job), the problems I encounter in my job are of such complexity that a very long (greater than six months) on-the-job training program would be necessary to adequately prepare someone for this job.

25. The problems I encounter in my job are of such complexity that no formal training provided for this job could possibly provide me with the capability of handling most of the problems.

26. In some aspects of a job we are often able to seek solutions to problems at a reasonable pace (rather than having to respond immediately with little or no time for analysis). In my job, most of the time I am forced to respond to problems without much analysis.

27. In my job most of the work I perform can be planned ahead of time (i.e., most of my work does not appear spontaneously).

28. I general, I would describe my work as being extremely difficult and complex.

29. Some jobs are <u>dependent</u> upon one another in the sense that the second job can be performed only if the first is performed. Of the tasks connected with my job, my job depends a great deal on someone else (or others) <u>in my work-group</u> doing their job first.

30. Some jobs are <u>dependent</u> upon one another in the sense that the second job can be performed only if the first is performed. Of the tasks connected with my job, my job depends a great deal on someone else (or others) <u>in another work-group(s)</u> doing their job first.

1 = Strongly disagree
2 = Moderately disagree
3 = Slightly disagree
4 = Neither agree nor disagree
5 = Slightly agree
6 = Moderately agree
7 = Strongly agree

31. Some jobs are dependent upon one another in the sense that the second job can be performed only if the first is performed. Of the tasks connected with my job, the job of someone else (or others) in my work-group depends a great deal on me doing my job first.

32. Some jobs are dependent upon one another in the sense that the second job can be performed only if the first is performed. Of the tasks connected with my job, the job of someone else (or others) in another-work group(s) depends a great deal on me doing my job first.

33. During an average week, the nature of my work is such that I interact a great deal with other members in my-work group about specific aspects of my work.

34. During an average week, the nature of my work is such that I interact a great deal with other members in another work-group(s) about specific aspects of my work.

35. The product(s) or service(s) provided by an organization may be categorized as being custom-designed (e.g., highly individualized to meet customer specifications) or they may be fairly standard (e.g., very similar for all customers). The product(s) or service(s) my work-group provides is relatively standard.

36. The product(s) or service(s) provided by an organization may be described as remaining relatively similar over time or they may change with some frequency (e.g., every year or so). The product(s) or service(s) my work-group provides remains relatively the same over time.

37. As part of the process of providing a product or service, every work group within an organization is required to complete certain tasks. In my work-group, the procedures and steps followed for completing our primary tasks are fairly standard and remain relatively similar over time.

38. The process (procedures used or steps taken) of providing a product or service may be fairly predictable (i.e., if you do this, that will happen) or not very predictable (i.e., you often are not sure whether something will work or not). In my work-group, the process(es) followed for completing our primary tasks is very predictable.

PERCEIVED PERFORMANCE

Instructions

Below are seven items (numbered 39 to 45) which relate to the performance of your work group as you view it. It is important that your answers reflect a thoughtful, honest response, reflecting the actual performance in your work group as you see it. Read each item carefully and then decide to what extent you agree with the item. Indicate the extent of your agreement by choosing the statement below which best represents your opinion and "blacken in" the corresponding number of that statement on the separate response sheet for items numbered 39 through 45.

1 = Strongly disagree
2 = Moderately disagree
3 = Slightly disagree
4 = Neither agree nor disagree
5 = Slightly agree
6 = Moderately agree
7 = Strongly agree

With respect to the seven items that follow, the term "output" needs some clarification. Every work-group member produces something in their work. "Output" refers to what each member produces. It may be a "product" or "service." But sometimes it is very difficult to identify the product or service for individual work-groups or their members. Below are listed some examples of the many products or services being produced by different work-groups in an organization:

- develop management information system requirements
- perform engineering assessment studies
- prepare staff papers
- develop and administrer contracts
- cost analysis
- job classification
- monitor new programs
- evaluate support requirements

These are just a few examples of the things being produced in this sample organization.

Please think carefully of the things you and your work-group members produce as you respond to the items below.

39. The quantity of output of your work-group members is very high.

40. The quality of output of your work-group members is very high.

1 = Strongly disagree
2 = Moderately disagree
3 = Slightly disagree
4 = Neither agree nor disagree
5 = Slightly agree
6 = Moderately agree
7 = Strongly agree

41. Your work-group members always get maximum output from the available resources (e.g., personnel, money, material).

42. Your work-group members do an excellent job in anticipating problems that may come up in the future and preventing them from occurring or by minimizing their effects.

43. When high priority work arises (e.g., short suspenses, crash programs and schedule changes) your work-group members do an excellent job in handling these situations.

44. When changes are made in the routines of your work-group (e.g., the structure, the tasks performed), your work-group members do an excellent job in accepting and adjusting to these.

45. Your work-group's performance in comparison to similar work-groups is very high.

THE NATURE OF THE JOB CONTROL PROCESS

Instructions

Below are 35 items (numbered 46 through 80) which relate to the manner in which your work is guided, directed, supervised and evaluated. Read each item carefully and then decide to what extent you agree with each item. Indicate the extent of your agreement by choosing the statement below which best represents your opinion and "blacken in" the corresponding number of that statement on the separate response sheet for items numbered 46 through 80.

1 = Strongly disagree
2 = Moderately disagree
3 = Slightly disagree
4 = Neither agree nor disagree
5 = Slightly agree
6 = Moderately agree
7 = Strongly agree

46. My immediate supervisor frequently keeps a close check on what I am doing.

47. My immediate supervisor has a great influence on what I do in a typical work week.

48. In some jobs we receive more direction and/or guidance from our immediate supervisor, in other jobs we receive more direction and/or guidance by indirect means (e.g., established policies/procedures from top management). Most of my work is guided/directed by <u>indirect</u> means.

49. Most of my normal, daily work activities are guided by written manuals/directives/rules which set forth the way I am to perform my job.

50. With regard to those tasks that are guided by written manuals/directives, my supervisor is very strict in requiring that I always follow them.

51. It seems as though there is a written rule for everything here.

52. Many jobs have specified <u>standards of work performance</u> which prescribe such things as the quantity and/or quality of work to be performed (e.g., you must produce so much at a certain rate and/or your output must meet a minimum standard of quality). In my job I am provided with very few specified standards of work performance.

1 = Strongly disagree
2 = Moderately disagree
3 = Slightly disagree
4 = Neither agree nor disagree
5 = Slightly agree
6 = Moderately agree
7 = Strongly agree

53. In my work it is very difficult to get anything done when I attempt to attain every standard of work performance which apply to my tasks.

54. In order to be successful in my job, if I had my way I would significantly reduce the number of specified standards of work performance which apply to my tasks.

55. I get my orders from the same person all the time.

56. The direction and guidance I receive on how to perform my job is always consistent from one day to the next.

57. In my job I often find myself in a bind trying to comply with the demands of more than one person.

58. It is nearly impossible to satisfy all the different requirements of my job.

59. On my job I have more than one boss telling me what to do.

60. Many jobs have a number of different rules prescribing <u>how</u> to proceed with your work. Regardless of how many different rules I must follow, in my job these rules are very <u>inconsistent</u> with one another--i.e., two or more rules seem to conflict extensively.

61. Many jobs have a number of different standards of work performance which prescribe such things as the quantity and/or quality of work to be performed. Regardless of how many different standards I must attempt to attain in my job, these standards are very <u>inconsistent</u> with one another--i.e., two or more standards seem to conflict extensively.

62. Many jobs have a number of different standards of work performance which prescribe such things as the quantity and/or quality of work to be performed. The standards of work performance in my job are very <u>acceptable</u> to me.

63. Many jobs have a number of different standards of work performance which prescribe such things as the quantity and/or quality of work to be performed. The standards of work performance in my job are very <u>realistic</u> (i.e., they are achievable yet challenging).

1 = Strongly disagree
2 = Moderately disagree
3 = Slightly disagree
4 = Neither agree nor disagree
5 = Slightly agree
6 = Moderately agree
7 = Strongly agree

64. Many jobs have a number of different standards of work performance which prescribe such things as the quantity and/or quality of work to be performed. In my job I feel a great deal of commitment to achieving these standards.

65. Many jobs have a number of different standards of work performance which prescribe such things as the quantity and/or quality of work to be performed. If I had my way, I would make some major changes in the prescribed standards pertaining to my job.

66. Many jobs have a number of different rules/procedures which guide or direct how to perform the work and how to behave on the job. The rules/procedures in my job are very acceptable to me.

67. Many jobs have a number of different rules/procedures which guide or direct how to perform the work and how to behave on the job. In my job I feel a great deal of commitment to following these rules/procedures.

68. Many jobs have a number of different rules/procedures which guide or direct how to perform the work and how to behave on the job. In my job the rules/procedures are very realistic.

69. My job permits me a great deal of discretion in deciding (on my own) how to go about doing the work.

70. My job denies me any chance to use my personal initiative or judgment in carrying out the work.

71. My job gives me considerable opportunity for independence and freedom in how I do the work.

72. When I encounter a difficult/complex problem which might involve the concerns of another work-group(s), I almost always go directly to the people involved without first checking with my supervisor.

73. This job allows me to make most decisions on my own.

74. This job gives me a great deal of freedom in deciding which tasks to perform.

1 = Strongly disagree
2 = Moderately disagree
3 = Slightly disagree
4 = Neither agree nor disagree
5 = Slightly agree
6 = Moderately agree
7 = Strongly agree

75. This job gives me a great deal of freedom in deciding in what order to perform tasks.

76. This job gives me a great deal of freedom in determining the pace at which I work.

77. When I am being evaluated in my job, a great deal of the weight is given to objective records which show specific output of the work performed.

78. A great deal of my work is evaluated on non-output measures such as how I go about doing the job, the manner in which I approach problems, etc.

79. My immediate supervisor checks on me frequently to see how I am doing my work.

80. My immediate supervisor is much more familiar with the final outcomes (output measures of my work) than with the day-to-day manner in which I go about performing it.

JOB SATISFACTION

Instructions

Below are 5 items (numbered 81 through 85) which relate to the degree to which you are satisfied with various aspects of your job. Read each item carefully and choose the statement below which best represents your opinion. "Blacken in" the corresponding number of that statement on the separate response sheet for items numbered 81 through 85.

1 = Delighted
2 = Pleased
3 = Mostly satisfied
4 = Mixed (about equally satisfied and dissatisfied)
5 = Mostly dissatisfied
6 = Unhappy
7 = Terrible

81. How do you feel about your job?

82. How do you feel about the people you work with--your coworkers?

83. How do you feel about the work you do on your job--the work itself?

84. What is it like where you work--the physical surroundings, the hours, the amount of work you are asked to do?

85. How do you feel about what you have available for doing your job--I mean equipment, information, good supervision, and so on?

BACKGROUND INFORMATION

Instructions

Below are 15 questions (numbered 86 through 100) which concern your background. This information is needed strictly to assess the representativeness of groups according to certain characteristics and NOT to identify you as an individual. On the separate response sheet please "blacken in" the number which corresponds to your response for each question numbered 86 through 100.

86. Total years in or working for the Air Force:

1. Less than 2 years.
2. More than 2 years, less than 4 years.
3. More than 4 years, less than 6 years.
4. More than 6 years, less than 8 years.
5. More than 8 years, less than 10 years.
6. More than 10 years, less than 12 years.
7. More than 12 years, less than 14 years.
8. More than 14 years, less than 16 years.
9. More than 16 years, less than 18 years.
10. More than 18 years.

87. Total months in present career field:

1. Less than 1 year.
2. More than 1 year, less than 2 years.
3. More than 2 years, less than 3 years.
4. More than 3 years, less than 4 years.
5. More than 4 years, less than 5 years.
6. More than 5 years, less than 6 years.
7. More than 6 years, less than 7 years.
8. More than 7 years, less than 8 years.
9. More than 8 years, less than 9 years.
10. More than 9 years.

88. Total months at this station:

1. Less than 6 months.
2. More than 6 months, less than 12 months.
3. More than 12 months, less than 18 months.
4. More than 18 months, less than 24 months.
5. More than 24 months, less than 30 months.
6. More than 30 months, less than 36 months.
7. More than 36 months.

89. Total months <u>in present organization</u>:

    1. Less than 6 months.
    2. More than 6 months, less than 12 months.
    3. More than 12 months, less than 18 months.
    4. More than 18 months, less than 24 months.
    5. More than 24 months, less than 30 months.
    6. More than 30 months, less than 36 months.
    7. More than 36 months.

90. Total months <u>in present work-group</u>:

    1. Less than 6 months.
    2. More than 6 months, less than 12 months.
    3. More than 12 months, less than 18 months.
    4. More than 18 months, less than 24 months.
    5. More than 24 months, less than 30 months.
    6. More than 30 months, less than 36 months.
    7. More than 36 months.

91. Total months <u>in present position</u>:

    1. More than 6 months.
    2. More than 6 months, less than 12 months.
    3. More than 12 months, less than 18 months.
    4. More than 18 months, less than 24 months.
    5. More than 24 months, less than 30 months.
    6. More than 30 months, less than 36 months.
    7. More than 36 months.

92. How many people are there in your work-group?

    1. 3 or less
    2. 4 to 6
    3. 7 to 9
    4. 10 to 12
    5. 13 to 15
    6. 16 to 18
    7. more than 18

93. How many people do you <u>directly</u> supervise?

    1. None
    2. 1
    3. 2
    4. 3
    5. 4
    6. 5
    7. 6
    8. 7
    9. 8
    10. more than 8

94. For how many people do you write performance reports?

1. None
2. 1
3. 2
4. 3
5. 4
6. 5
7. 6
8. 7
9. 8
10. more than 8

95. Does your supervisor actually write your performance reports?

1. Yes
2. No
3. Not sure

96. Your highest education level obtained is:

1. Non-high school graduate
2. High school graduate or GED
3. Less than two years college
4. Two years or more college
5. Bachelors Degree
6. Masters Degree
7. Doctoral Degree

97. Your work requires you to work primarily:

1. Alone
2. With one or two people
3. As a small group team member (3 to 5 people)
4. As a large group team member (6 or more people)
5. Other

98. Your sex is:

1. Male
2. Female

99. You are a (an):

1. Officer
2. Airman
3. Civilian (GS)
4. Civilian (Wage Employee)
5. Non-Appropriated Fund (NAF) Employee
6. Other

100. Your grade level is:

1. 1-2
2. 3-4
3. 5-6
4. 7-8
5. 9-10
6. 11-12
7. 13-14
8. 15-16
9. Higher than 16

APPENDIX C

MEASURES OF THE VARIABLES

APPENDIX C

MEASURES OF THE VARIABLES

This appendix consists of five sections. Each section describes a component of the questionnaire. Sections I, II and III refer to measures of Technology, Performance, and Control respectively. Section IV refers to the measure of Job Satisfaction. Section V describes the Background Information portion of the questionnaire. With the exception of the Background Information items, all items on the questionnaire used seven-point Likert-type responses. In this appendix, we have identified for each questionnaire item the "variable numbers" used in the analysis as well as the "questionnaire number" (which refers to the placement of the item in the questionnaire). The questionnaire consisted of 100 items, including the Background Information portion.

Section I. Measurement of Technological Routineness

Included are four separate indices which together incorporate measures of raw materials, knowledge and operations technology and are based upon measures of earlier research (e.g., Woodward, 1965; Perrow, 1967; Bell, 1965; Lynch, 1974; Van de Ven and Delbecq, 1974). All 38 questionnaire items in Section I used seven-point Likert-type responses: i.e., 1 = strongly disagree through 7 = strongly agree.

A. Index of Task Predictability and Task Variability

The following index measures both the predictability and variability of tasks and is focused upon raw materials and knowledge technology primarily, and to some extent on operations technology. High predictability and low variability indicate high routineness). The following items receive reverse scoring: 2, 7 through 11, 13 through 15.

Variable Number	Questionnaire Number	
V1	1.	I do about the same job in the same way most of the time.
V2	2.	There is a great deal of variety in the work I do.
V3	3.	Regardless of the variety of work I do, the methods I use to do it are about the same.
V4	4.	Think of the different work inputs which generate work for you (e.g., requests or requirements made by a supervisor, another office worker, another work-group, another organization). In my job I am able to anticipate and predict the frequency of these work inputs most of the time.
V5	5.	In my job I encounter the same kinds of problems most of the time.
V6	6.	Many jobs require the use of searching procedures (to search for information essential to accomplishing the work). The searching procedures I use in my job are very similar from one day to the next.
V7	7.	The decisions I make in my job are very dissimilar from one day to the next.
V8	8.	It is very difficult to learn enough about my job to handle all the different problems that come up.

Variable Number	Questionnaire Number	
V9	9.	I encounter a great deal of variety in the type or kinds of tasks in my job.
V10	10.	I encounter a great deal of variety in the types of methods I use to perform my work.
V11	11.	In my job I basically perform repetitive activities from one day to the next.
V12	12.	Regardless of the variety of work I do, my job is mainly concerned with routine matters.
V13	13.	In my job there is a great deal of variety in the events that cause or generate my work.
V14	14.	In my job there is a great deal of uncertainty about the appropriateness of a given procedure (method) to use in accomplishing a given task.
V15	15.	In my job it is very difficult to predict the work/tasks I'll be performing from one day to the next.

B. Index of Task Difficulty or Complexity

The following index measures the difficulty of tasks and is focused upon raw materials and knowledge technology. Low difficulty indicates high routineness (vis-à-vis nonroutineness). The following items receive reverse scoring: 17, 19, 20, 24 through 26, 28.

Variable Number	Questionnaire Number	
V16	16.	There is a clear and understandable sequence of steps that I follow in doing most of my work.
V17	17.	In the course of my job I frequently encounter difficult problems which I don't know how to solve immediately.

Variable Number	Questionnaire Number	
V18	18.	The majority of the problems I encounter in my job are similar from one day to the next.
V19	19.	The problems I encounter in my job are of such a nature that they require a great deal more time devoted to "thinking" (e.g., trying to define them specifically, deciding what further information is needed to identify causes and/or potential alternative solutions, etc.) than to actually acting on some solution(s).
V20	20.	The problems I encounter in my job are of such complexity that they require a great deal of consultation with others (in or outside of your work-group) and/or they require a great deal of reference to written guidelines/procedures before I can act on some solution(s).
V21	21.	If, in my job, I encounter some problem that I don't know how to handle, there are others I can readily consult with who will know how to resolve it.
V22	22.	If, in my job, I encounter some problem that I don't know how to handle, there is documentation (written guidelines, procedures, etc.) I can readily consult to show me how to resolve it.
V23	23.	In some jobs things are fairly predictable. In others, you are often not sure what the outcome will be. In my job I am sure what the results of my efforts will be most of the time.
V24	24.	Aside from formal training (i.e., the basic prerequisite training required of all job applicants for my job), the problems I encounter in my job are of such complexity that a very long (greater than six months) on-the-job training program would be necessary to adequately prepare someone for this job.
V25	25.	The problems I encounter in my job are of such complexity that no formal training provided for this job could possibly provide me with the capability of handling most of the problems.

Variable Number	Questionnaire Number	
V26	26.	In some aspects of a job we are often able to seek solutions to problems at a reasonable pace (rather than having to respond immediately with little or no time for analysis). In my job, most of the time I am forced to respond to problems without much analysis.
V27	27.	In my job most of the work I perform can be planned ahead of time (i.e., most of my work does not appear spontaneously).
V28	28.	In general, I would describe my work as being extremely difficult and complex.

C. Index of Task Interdependence

The following index measures the interdependence of tasks and is focused upon knowledge and operations technology primarily. Low interdependence indicates high routineness (vis-à-vis nonroutineness). All six items receive reverse scoring.

Variable Number	Questionnaire Number	
V29	29.	Some jobs are dependent upon one another in the sense that the second job can be performed only if the first is performed. Of the tasks connected with my job, my job depends a great deal on someone else (or others) in my work-group doing their job first.
V30	30.	Some jobs are dependent upon one another in the sense that the second job can be performed only if the first is performed. Of the tasks connected with my job, my job depends a great deal on someone else (or others) in another work-group(s) doing their job first.
V31	31.	Some jobs are dependent upon one another in the sense that the second job can be performed only if the first is performed. Of the tasks connected with my job, the job of someone else (or others) in my work-group depends a great deal on me doing my job first.

Variable Number	Questionnaire Number	
V32	32.	Some jobs are dependent upon one another in the sense that the second job can be performed only if the first is performed. Of the tasks connected with my job, the job of someone else (or others) in another work-group(s) depends a great deal on me doing my job first.
V33	33.	During an average week, the nature of my work is such that I interact a great deal with other members in my work-group about specific aspects of my work.
V34	34.	During an average week, the nature of my work is such that I interact a great deal with other members in another work-group(s) about specific aspects of my work.

D. Index of the Nature of Production Process

The following index measures the nature of the production process, i.e., focusing on operations technology. Specifically, these measures are based upon Woodward's (1965) distinctions between unit, mass and process technologies with respect to standardization of product/services and the process of production. High standardization indicates high routineness (vis-à-vis nonroutineness).

Variable Number	Questionnaire Number	
V35	35.	The product(s) or service(s) provided by an organization may be categorized as being custom-designed (e.g., highly individualized to meet customer specifications) or they may be fairly standard (e.g., very similar for all customers). The product(s) or service(s) my work-group provides is relatively standard.

Variable Number	Questionnaire Number	
V36	36.	The product(s) or service(s) provided by an organization may be described as remaining relatively similar over time or they may change with some frequency (e.g., every year or so). The product(s) or service(s) my work-group provides remains relatively the same over time.
V37	37.	As part of the process of providing a product or service, every work-group within an organization is required to complete certain tasks. In my work-group, the procedures and steps followed for completing our primary tasks are fairly standard and remain relatively similar over time.
V38	38.	The process (procedures used or steps taken) of providing a product or service may be fairly predictable (i.e., if you do this, that will happen) or not very predictable (i.e., you often are not sure whether something will work or not). In my work-group, the process(es) followed for completing our primary tasks is very predictable.

Section II. Measurement of Perceived Performance

Included here is one index which measures work-group perform ance as perceived by the work-group members. This index consists of seven items measuring various components of performance. These com- ponents include quantity and quality of work, resource utilization, ability to anticipate problems and changes, flexibility, and adaptab ity. These items are based to a great extent on the works of Mott (1972) and Hendrix and Halverson (1979) as well as upon the conceptu izations of major criteria of effectiveness described in various sou (e.g., Schein, 1970; Steers, 1977; Goodman, et al., 1979; and Lawler et al., 1980). All seven items were measured on a seven-point scale i.e., 1 = strongly disagree through 7 = strongly agree. High scores reflect high work-group performance.

Variable Number	Questionnaire Number	
V39	39.	The quantity of output of your work-group memb is very high.
V40	40.	The quality of output of your work-group membe is very high.
V41	41.	Your work-group members always get maximum out from the available resources (e.g., personnel, money, material).
V42	42.	Your work-group members do an excellent job in anticipating problems that may come up in the future and preventing them from occurring or b minimizing their effects.
V43	43.	When high priority work arises (e.g., short su penses, crash programs and schedule changes) your work-group members do an excellent job in handling these situations.

Variable Number	Questionnaire Number	
V44	44.	When changes are made in the routines of your work-group (e.g., the structure, the tasks performed), your work-group members do an excellent job in accepting and adjusting to these.
V45	45.	Your work-group's performance in comparison to similar work-groups is very high.

Section III. Measurement of the Control Process

Section III is divided into four parts, each pertaining to a potentially distinct aspect of the nature of the control process. Part one includes two indices (based upon the theoretical formulations of Woodward, 1970) which constitute the proposed dimension labelled "the degree of personalization in exercising control." Part two includes three indices (based upon the theoretical formulations of Woodward, 1970 and McMahon and Perritt, 1971) which constitute the proposed dimension labelled "the degree of unity in exercising control." Part three includes an index which measures the proposed dimension labelled "the degree of autonomy/discretion given in exercising control." Part four includes an index which measures the two modes of control proposed by Ouchi and Maguire (1975), i.e., behavior and output control. All 35 questionnaire items in Section III used seven-point Likert-type responses: i.e., 1 = strongly disagree through 7 = strongly agree.

Part One: Degree of Personalization in Exercising Control

A. Index of Emphasis on Direct, Personal Control

The following index measures the extent of direct, personal control (vis-à-vis indirect, impersonal). High direct control indicates high personal (vis-à-vis impersonal) control of workers. Item 48 receives reverse scoring.

Variable Number	Questionnaire Number
46	46. My immediate supervisor frequently keeps a close check on what I am doing.

Variable Number	Questionnaire Number	
V47	47.	My immediate supervisor has a great influence on what I do in a typical work week.
V48	48.	In some jobs we receive more direction and/or guidance from our immediate supervisor, in other jobs we receive more direction and/or guidance by indirect means (e.g., established policies/procedures from top management). Most of my work is guided/directed by indirect means.

B. Index of Emphasis on Rule Usage

The following index measures the extent of the emphasis on use of written rules (procedures/guidelines directing the means by which tasks are to be performed). Low emphasis on rule usage indicates high personal (vis-à-vis impersonal) control. All three items receive reverse scoring.

Variable Number	Questionnaire Number	
V49	49.	Most of my normal, daily work activities are guided by written manuals/directives/rules which set forth the way I am to perform my job.
V50	50.	With regard to those tasks that are guided by written manuals/directives, my supervisor is very strict in requiring that I always follow them.
V51	51.	It seems as though there is a written rule for everything here.

Part Two: Degree of Unity in Exercising Control

A. Index of Quantity of Performance Standards to be Attained

The following index measures the extent of formal standards of work performance (i.e., specifications prescribing the quantity

and/or quality of output to be achieved or attained by workers in their job). Low numbers of performance standards indicate a high united (vis-à-vis disunited) control process. Items 53 and 54 receive reverse scoring.

V52 52. Many jobs have specified standards of work performance which prescribe such things as the quantity and/or quality of work to be performed (i.e., you must produce so much at a certain rate and/or your output must meet a minimum standard of quality). In my job I am provided with very few specified standards of work performance.

V53 53. In my work it is very difficult to get anything done when I attempt to attain every standard of work performance which apply to my tasks.

V54 54. In order to be successful in my job, if I had my way I would significantly reduce the number of specified standards of work performance which apply to my tasks.

B. Index of the Extent of Compatibility Between Performance Standards to be Attained and the Extent of Compatibility Between Rules/Procedures to be Followed

The following index measures (1) the extent of compatibility between the various specified standards of work performance to be attained (i.e., the specifications of quantity and/or quality of the output workers are expected to achieve), and (2) the extent of compatibility between the various rules/procedures to be followed (i.e., the guidelines or directions which prescribe how to perform the work, how to behave on the job, etc.). High compatibility between performance standards and high compatibility between rules/procedures indicates a high united (vis-à-vis disunited) control process. Items 57 through 61 receive reverse scoring.

Variable Number	Questionnaire Number	
V55	55.	I get my orders from the same person all the time.
V56	56.	The direction and guidance I receive on how to perform my job is always consistent from one day to the next.
V57	57.	In my job I often find myself in a bind trying to comply with the demands of more than one person.
V58	58.	It is nearly impossible to satisfy all the different requirements of my job.
V59	59.	On my job I have more than one boss telling me what to do.
V60	60.	Many jobs have a number of different rules prescribing <u>how</u> to proceed with your work. Regardless of how many different rules I must follow, in my job these rules are very <u>inconsistent</u> with one another--i.e., two or more rules seem to conflict extensively.
V61	61.	Many jobs have a number of different standards of work performance which prescribe such things as the quantity and/or quality of work to be performed. Regardless of how many different standards I must attempt to attain in my job, these standards are very <u>inconsistent</u> with one another--i.e., two or more standards seem to conflict extensively.

C. <u>Index of the Extent of Acceptance of or Incentive to Attain/Comply with Both Performance Standards and Rules/Procedures</u>

The following index measures the extent of acceptance of or incentive to attain/comply with (1) the various specified standards of work performance (i.e., the specifications of quantity and/or quality of the output workers are expected to achieve), and (2) the various rules/procedures to be followed (i.e., the guidelines or directions which prescribe how to perform the work, how to behave on

the job, etc.). High acceptance or incentive to attain/comply with performance standards and rules/procedures indicates a high united (vis-à-vis disunited) control process. Item 65 receives reverse scoring.

Variable Number	Questionnaire Number	
V62	62.	Many jobs have a number of different standards of work performance which prescribe such things as the quantity and/or quality of work to be performed. The standards of work performance in my job are very acceptable to me.
V63	63.	Many jobs have a number of different standards of work performance which prescribe such things as the quantity and/or quality of work to be performed. The standards of work performance in my job are very realistic (i.e., they are achievable yet challenging).
V64	64.	Many jobs have a number of different standards of work performance which prescribe such things as the quantity and/or quality of work to be performed. In my job I feel a great deal of commitment to achieving these standards.
V65	65.	Many jobs have a number of different standards of work performance which prescribe such things as the quantity and/or quality of work to be performed. If I had my way, I would make some major changes in the prescribed standards pertaining to my job.
V66	66.	Many jobs have a number of different rules/procedures which guide or direct how to perform the work and how to behave on the job. The rules/procedures in my job are very acceptable to me.
V67	67.	Many jobs have a number of different rules/procedures which guide or direct how to perform the work and how to behave on the job. In my job I feel a great deal of commitment to following these rules/procedures.

Variable Number	Questionnaire Number	
V68	68.	Many jobs have a number of different rules/procedures which guide or direct how to perform the work and how to behave on the job. In my job the rules/procedures are very <u>realistic</u>.

<u>Part Three: Degree of Autonomy/Discretion Given in Exercising Control</u>

<u>Index of Autonomy/Discretion</u>

The following index measures the extent of autonomy/discretion in the work. <u>High</u> scores indicate <u>high</u> autonomy. Item 70 receives reverse scoring.

Variable Number	Questionnaire Number	
V69	69.	My job permits me a great deal of discretion in deciding (on my own) how to go about doing the work.
V70	70.	My job denies me any chance to use my personal initiative or judgment in carrying out the work.
V71	71.	My job gives me considerable opportunity for independence and freedom in how I do the work.
V72	72.	When I encounter a difficult/complex problem which might involve the concerns of another work-group(s), I almost always go directly to the people involved without first checking with my supervisor.
V73	73.	This job allows me to make most decisions on my own.
V74	74.	This job gives me a great deal of freedom in deciding which tasks to perform.
V75	75.	This job gives me a great deal of freedom in deciding in what order to perform tasks.
V76	76.	This job gives me a great deal of freedom in determining the pace at which I work.

Part Four: Behavior-Output Control

Index of Behavior-Output Control

The following index measures the extent to which behavior control (monitoring and evaluation of behavior or of how the task is being performed) is applied vis-à-vis output control (monitoring and evaluation of the end product, final output). This index is based upon the theoretical formulations and measures of Ouchi and Maguire (1975). High scores indicate high behavior (vis-à-vis output) control of workers. Items 77 and 80 receive reverse scoring.

Variable Number	Questionnaire Number	
V77	77.	When I am being evaluated in my job, a great deal of the weight is given to objective records which show specific output of the work performed.
V78	78.	A great deal of my work is evaluated on non-output measures such as how I go about doing the job, the manner in which I approach problems, etc.
V79	79.	My immediate supervisor checks on me frequently to see how I am doing my work.
V80	80.	My immediate supervisor is much more familiar with the final outcomes (output measures of my work) than with the day-to-day manner in which I go about performing it.

Section IV. Measurement of Job Satisfaction

Section IV is composed of the "Job Index" of Andrews and Withey (1975). The Job Index consists of five variables (items) measuring satisfaction with different aspects of the job. The scale used is the same as that used by Andrews and Withey and is shown below:

Scale:
1. Delighted
2. Pleased
3. Mostly satisfied
4. Mixed (about equally satisfied and dissatisfied)
5. Mostly dissatisfied
6. Unhappy
7. Terrible

Variable Number	Questionnaire Number	
V81	81.	How do you feel about your job?
V82	82.	How do you feel about the people you work with--your co-workers?
V83	83.	How do you feel about the work you do on your job--the work itself?
V84	84.	What is it like where you work--the physical surroundings, the hours, the amount of work you are asked to do?
V85	85.	How do you feel about what you have available for doing your job--I mean equipment, information, good supervision, and so on?

Section V. Background Information

This section consists of 15 background information items, many of which are written specifically for Air Force personnel.

Variable Number	Questionnaire Number	
V86	86.	Total years in or working for the Air Force:
		1. Less than 2 years.
		2. More than 2 years, less than 4 years.
		3. More than 4 years, less than 6 years.
		4. More than 6 years, less than 8 years.
		5. More than 8 years, less than 10 years.
		6. More than 10 years, less than 12 years.
		7. More than 12 years, less than 14 years.
		8. More than 14 years, less than 16 years.
		9. More than 16 years, less than 18 years.
		10. More than 18 years.
V87	87.	Total months in present career field:
		1. Less than 1 year.
		2. More than 1 year, less than 2 years.
		3. More than 2 years, less than 3 years.
		4. More than 3 years, less than 4 years.
		5. More than 4 years, less than 5 years.
		6. More than 5 years, less than 6 years.
		7. More than 6 years, less than 7 years.
		8. More than 7 years, less than 8 years.
		9. More than 8 years, less than 9 years.
		10. More than 9 years.
V88	88.	Total months <u>at this station</u>:
		1. Less than 6 months.
		2. More than 6 months, less than 12 months.
		3. More than 12 months, less than 18 months.
		4. More than 18 months, less than 24 months.
		5. More than 24 months, less than 30 months.
		6. More than 30 months, less than 36 months.
		7. More than 36 months.

Variable Number	Questionnaire Number	
V89	89.	Total months <u>in present organization</u>:

1. Less than 6 months.
2. More than 6 months, less than 12 months.
3. More than 12 months, less than 18 months.
4. More than 18 months, less than 24 months.
5. More than 24 months, less than 30 months.
6. More than 30 months, less than 36 months.
7. More than 36 months.

V90 — 90. Total months <u>in present work-group</u>:

1. Less than 6 months.
2. More than 6 months, less than 12 months.
3. More than 12 months, less than 18 months.
4. More than 18 months, less than 24 months.
5. More than 24 months, less than 30 months.
6. More than 30 months, less than 36 months.
7. More than 36 months.

V91 — 91. Total months <u>in present position</u>:

1. Less than 6 months.
2. More than 6 months, less than 12 months.
3. More than 12 months, less than 18 months.
4. More than 18 months, less than 24 months.
5. More than 24 months, less than 30 months.
6. More than 30 months, less than 36 months.
7. More than 36 months.

V92 — 92. How many people are there in your work-group?

1. 3 or less
2. 4 to 6
3. 7 to 9
4. 10 to 12
5. 13 to 15
6. 16 to 18
7. more than 18

V93 — 93. How many people do you <u>directly</u> supervise?

1. None
2. 1
3. 2
4. 3
5. 4
6. 5
7. 6
8. 7
9. 8
10. more than 8

Variable Number	Questionnaire Number	
V94	94.	For how many people do your write performance reports?

1. None
2. 1
3. 2
4. 3
5. 4
6. 5
7. 6
8. 7
9. 8
10. more than 8

V95 95. Does your supervisor actually write your performance re‚ort?

1. Yes 2. No 3. Not sure

V96 96. Your highest education level obtained is:

1. Non-high school graduate
2. High school graduate or GED
3. Less than two years college
4. Two years or more college
5. Bachelors Degree
6. Masters Degree
7. Doctoral Degree

V97 97. Your work requires you to work primarily:

1. Alone
2. With one or two people
3. As a small group team member (3 to 5 people)
4. As a large group team member (6 or more people)
5. Other

V98 98. Your sex is:

1. Male
2. Female

V99 99. You are a (an):

1. Officer
2. Airman
3. Civilian (GS)
4. Civilian (Wage Employee)
5. Non-appropriated Fund (NAF) Employee
6. Other

Variable Number	Questionnaire Number
V100	100. Your grade level is:

1. 1-2
2. 3-4
3. 5-6
4. 7-8
5. 9-10
6. 11-12
7. 13-14
8. 15-16
9. Higher than 16

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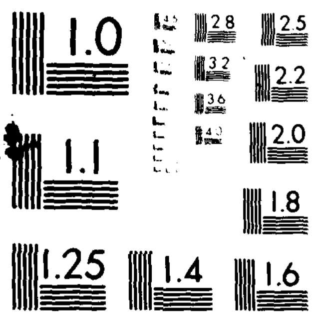

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